The "Virtual Corporation" and Army Organization

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PREFACE

This project seeks to understand how the organizational structure of commercial corporations has changed over the past 10–15 years, in order to understand what lessons might be applied to the U.S. Army. Many of these changes have been greatly facilitated by advances in information technology, and part of the project's goal was to understand how the ongoing information revolution might make possible organizational innovations.

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The next twenty years are likely to see very substantial changes in the nature of all organizations, whether civilian or military. One important factor facilitating and, to some extent, driving these changes will be information technology (IT), whose relentless advance—it is said that the performance/price ratio of central processing units (CPUs) doubles every 18 months—is not expected to abate any time in the foreseeable future. As in previous technological revolutions, however, the second- and third-order effects of the changes will not be felt until organizations adapt and learn how to take advantage of new capability. We cannot predict how these changes will evolve, but we can extrapolate from recent trends and argue by analogy from earlier revolutions in information technology. Although discussion of the "revolution in military affairs" has centered around the impact of technology on weapons systems, there are reasons for thinking that more fundamental improvements in military effectiveness will require, along with doctrinal changes, the use of appropriate organizational structures.

Changes in the ways that commercial organizations do business have already been tremendous, and most observers believe we are witnessing only the tip of a large iceberg. Product cycles for complex, high-tech goods have been radically shortened, requiring in some cases a mere eighteen months between concept and marketed product; markets themselves have become much more complex, segmented, and demanding; production and markets have become

globalized; and services now dominate the production of new wealth. To an ever-increasing degree, the economy is moving from an industrial-age model, in which machines and natural resources are used to produce material product, to the "information-based organization" that produces goods or services through the use of human capital.

The actual and predicted consequences for commercial organizations are dramatic. The key initiatives involve speeding up the flow of information through an organization, and creating the proper conditions and incentives for taking action on the basis of that information. Overall, it is argued that companies as a whole will become smaller; that large, vertically integrated corporations will either flatten their managerial hierarchies or else evolve into networks of smaller, more agile firms; that low-skill labor will continue to be devalued and replaced by work with greater skill and cognitive requirements; and that self-organized teams will displace individual effort. All corporations will have to operate in a much more uncertain and chaotic environment and will therefore place a premium on flexibility, learning, and adaptability. They will have to be designed in more of the self-organizing fashion of biological systems, rather than being conceived as elaborate mechanical systems designed and controlled from the top.

As an organization flattens its hierarchy, a number of factors have to be kept in mind. Decentralization is not an end in itself; there are certain functions performed in organizations that are better performed by centralized authority than on a distributed basis.[1] Centralized organizations generally can move more quickly and decisively than decentralized ones, and they can achieve scale economies more readily; on the other hand, they may adapt more slowly to changed circumstances, and problems at the "center" may tend to paralyze activity throughout the organization. A military organization seeking to accomplish a specific goal in the near future needs

[1]More generally, it must be remembered that questions of organizational structure (e.g., centralization versus decentralization) are, although of great importance given their widespread effects, only a part of the larger subject of management methods and the ways in which they are changing. Thus, issues of organizational structure must be considered in the context of many other variables; there is no "one size fits all" solution.

centralized command authority; a military seeking to adapt to a fast-changing and uncertain external environment needs a higher degree of decentralization in order to adapt adequately. Today's Army is arguably in the latter situation: given that it is very hard to predict the kinds of wars it will fight or the weapons it will use in another 20–30 years, the key to a successful future Army is sufficient flexibility and adaptability to adjust rapidly to changes in future environment.

THE MILITARY AS A FLAT ORGANIZATION

While an army might at first seem the epitome of a large, hierarchical organization, there has been a long tradition of flat armies that predates similar innovations in the commercial sector by several decades, if not generations. Military organizations have always faced problems of poor information—and more severe ones than their commercial counterparts do, since they face an enemy using all means to deliberately disrupt their flow of information. Motivation in military organizations has always been social in addition to individual, moreover, since combat involves the risk of death; it is no surprise, therefore, that "teams" have been widely used in armies before they were introduced into factories.

There are a number of historical instances of flat combat organizations. Napoleon's headquarters at the Battle of Jena in 1806 directly controlled eight separate corps with no intermediate command echelon. So broad a span of control was possible only because each corps was trained and equipped to act autonomously; indeed, on the day of the Battle of Jena, Napoleon failed to communicate with two of his corps, while a third went on to win the battle of Auerstädt without his knowledge.

The Prussian army had a long tradition of encouraging independent action on the part of subordinate commanders, and in World War I the German army began experimenting with storm trooper battalions that were trained to fight with a high degree of independence. The storm trooper concept failed during the 1918 Ludendorff offensive because of inadequate information technology; the German command was unable to reallocate reserves and fires because it did not know where local breakthroughs had occurred. This problem was essentially solved, however, by the development of *Blitzkrieg* during the 1920s and 1930s; use of independent tank formations and

the mobile radio permitted the sort of fluid, fast-moving operations and flat command structure originally envisioned for storm trooper battalions.

In many ways, the U.S. Army incorporated these German concepts of flat military organization into its own training and doctrine in the postwar period. "Mission orders," "commander's intent," and similar terms related to maneuver warfare have all entered into Army doctrine. While the 1986 version of Field Manual 100-5 lays greater emphasis on maneuver warfare and decentralized command and control than the 1993 version does, both documents stress the importance of lateral communications, initiative and risk-taking on the part of subordinate officers, and the need for senior officers to concentrate on planning and other high-level functions rather than the overseeing of detailed execution.

If it is true, as a number of critics have argued, that U.S. Army command and control nevertheless remains too centralized, hierarchical, and inflexible, it is a problem not so much of doctrine than of the way that doctrine is implemented. There are a number of functions in military organizations that either require centralized command authority or else encourage an excessive degree of centralization. It is critical to sort out functions that need to be centralized and those that are better devolved to lower levels of the organization. Among the factors encouraging centralization are

- Strategic planning
- Fire support
- Logistics
- Medevac
- Intelligence
- Political factors.

Of particular concern is the possibility that development of the so-called revolution in military affairs (RMA), which will permit U.S. forces to bring to bear highly precise fires from a wide variety of platforms, will encourage more centralized control systems for the sake of the deconfliction and efficient allocation of fires.

IMPLICATIONS FOR THE ARMY

Many of the changes we anticipate for the U.S. Army in the future have already been sanctioned by doctrine but cannot today be implemented, and may not be fully implementable by Army XXI. For example, FM 100-5 describes the "nonlinear" battlefield, whose workability is currently limited by inadequate communications, logistics, medevac, etc. Extrapolation from present trends suggests the following organizational changes.

Number of Echelons

Advances in IT suggest that the "Pentomic" structure, which eliminated one echelon below division level, may now be more feasible than it was when first proposed in the 1950s.[2] The possibility of greater lateral communication, combined with "informated" reporting systems and automatic processing of routine data, may make the flatter organization structure advantageous. More generally, it may be advantageous to assign responsibility for specialized functions in ways that skip some echelons. For example, a "Wal-Mart"-type system for logistics would allow some data to flow from the field directly back to depots in the continental United States (CONUS); intermediate echelons could access the data but would not be responsible for processing it. At those echelons, commanders would manage "by exception," i.e., they would be able to adjust operation of the system when they felt it necessary.

Similarly, command structures may have to be streamlined to handle areas of particular political sensitivity. One possibility would be to reduce the number of layers between the on-scene commander of a politically sensitive operation and Washington, at least with respect to the major operational questions. The intervening levels may still be necessary for logistical and other forms of support. But if they hinder direct communication between the field and Washington, they make it harder for the on-scene commander to understand the political constraints under which he is operating.

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[2]For an overview of the historical Pentomic experiment, see Andrew J. Bacevich, *The Pentomic Era* (Washington, D.C.: National Defense University Press, 1986).

Size

The lethality of all weapon systems is constantly increasing, and the RMA will provide many alternative nonorganic sources of fires. In addition, many of the threats faced in the early 21st century may be considerably smaller than those NATO planned for during the Cold War. The consequence of these intersecting developments may be the "downsizing" of military units and a lightening of logistics loads, in ways that will make them easier to deploy and more flexible in their uses.

Procurement

An overall reform of the defense procurement system will no doubt be very difficult to achieve. In the meantime, recent experience suggests some strategies for chipping away at the problem.

For example, the development (during the Gulf War) of an earth-penetrating bomb in six weeks shows what the system can actually do under the right circumstances. We should be looking for and exploiting other instances in which accelerated development could be justified (e.g., air-implanted personnel or light vehicle sensors for use in Bosnia); not only would this provide deployed forces with useful capabilities they would not otherwise have, but it would accustom us to rapid and flexible operation and highlight the costs of the usual system. Similarly, the use in the field of systems such as JSTARS and Predator before they officially become operational suggests that a blurring of the line between the developmental and operational phases is not only possible but very advantageous. In general, past experience must be studied and imitated where appropriate, and we should seek and exploit opportunities to gain relevant new experience.

Personnel and Training

An army that requires lower-ranked officers and men to exercise greater initiative and assume greater responsibility must ensure that those personnel have adequate training and expertise. Some corporations have responded to this challenge by separating the processes of career development and promotion to make sure that specialists

can be adequately rewarded for good performance without having to join management ranks and hence cease practicing their specialty. (To some extent, the armed forces do the same by providing an enlisted promotion path through E-9 without leaving enlisted ranks; this appears to keep a great deal of expertise and experience in closer contact with the troops than would be the case if advancement beyond, say, E-5 required becoming an officer.) In the future the Army may have to apply this principle to various specialties in order to keep expertise at the lower levels of the organization. This may require going beyond current practices with respect to incentives for needed MOSs and officer career specialties.

Reducing the number of echelons and keeping more expertise at the lower levels may, however, make it more difficult to train officers for high command, since advancement through the ranks has been the main method of preparation. In addition, the handling of certain specialized functions, such as logistics, by "informated" systems that bypass some echelons implies that officers serving at those echelons will lack experience in overseeing those functions; thus, it will be only at the higher levels that officers will gain experience in dealing with the whole range of support functions.

This implies that even more attention will have to be paid to training in the future than is now the case. The proliferation of IT offers many possibilities for making training more realistic; in particular, command post exercises can be run at a much greater level of detail.

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Chapter One

ORGANIZATIONAL TRENDS IN THE COMMERCIAL SECTOR

STUDY OVERVIEW

The purpose of this study is to look at the changes that have occurred in the organizational structure of commercial corporations in recent years—particularly those changes most affected by the revolution in information technology (IT)—and to outline the ways in which they may apply to the U.S. Army. Broadly speaking, the Army developed as an institution in the post–Civil War period in tandem with the large, hierarchical, vertically integrated American corporation. Both shared a number of features, including an extensive division of labor and a large number of command-and-control echelons. Today the hierarchical corporation is evolving, with the help of IT, into a far more decentralized, and in many cases smaller, institution as it seeks to adapt to the late-20th-century global economic environment. In doing so, corporations which have adopted new types of organizational structure have achieved striking gains in productivity and international competitiveness.[1] The question naturally arises as to whether that other large industrial-era organization—the U.S. Army—might benefit from similar sorts of changes.

[1]Organizational structure is only one of several important related areas in organizational design that have received attention in recent years. These areas include process (how work is accomplished); monitoring (how work is overseen); incentives (how individuals are motivated, including, e.g., the promotion system); and leadership (how supervision affects the work). This study focuses on organizational structure but deals with some of these other issues as they are affected by questions of structure.

THE CHANGING CORPORATE ENVIRONMENT

Over the past generation, corporations have undergone a series of dramatic changes in organizational structure as they have sought to cope with a rapidly evolving economic environment. The U.S. economy has led the global economy in moving rapidly from an industrial-age model centering around the manufacture of material product to an information-age one producing primarily services. Underlying this change is the fact that wealth in an advanced industrial economy is increasingly the product of human rather than physical capital, and that the creation and manipulation of knowledge is the source of marginal productivity gains.

This shifting economic scene has meant that commercial organizations today face a highly demanding and uncertain environment, characterized by several important features. In the first place, product cycles have been dramatically shortened. New automobiles are now brought to market in two or three years, instead of six or seven;[2] in high-technology areas, new products are often marketed a mere eighteen months after being conceived. Perhaps the most remarkable example has been the semiconductor industry's ability to double processing power roughly every eighteen months for the past several decades, bringing about huge increases in the power and capabilities of modern information systems. This in turn has helped other industries shorten their product cycles, although the general phenomenon is broadly based and not simply dependent on IT.

Markets themselves have become highly segmented, complex, and fast-changing. Henry Ford boasted in the 1920s that his customers could buy a Model T in any color as long as it was black; today the Ford Motor Company produces hundreds of different varieties of vehicles—indeed, thousands, if one takes into account product differentiation by features, styling, color, and the like. As customers have become wealthier and better educated, they have also become far more demanding in terms of not just price but quality, design, financing terms, delivery schedules, and service. Companies win customers not by offering them commodity-like products at the

[2]See James P. Womack, Daniel T. Jones, and Daniel Roos, *The Machine That Changed the World: The Story of Lean Production* (New York: HarperPerennial, 1991), pp. 104–112.

lowest price, but by giving them a constantly changing product line that responds to their changing tastes and requirements.[3]

A third change in the environment has been globalization. Vastly increased communications capacities, along with steadily dropping transportation costs, have made it possible to produce and market in a far wider range of countries than previously. This has contributed to the increasing complexity and segmentation of markets noted above. To take advantage of globalization, companies have to master a far wider range of information on labor and materials costs, markets, consumer preferences, and the like.

The final characteristic of the new economic environment is the position of services as the preeminent component of economic output and of knowledge and human capital as the single most important input. It is true that many of the great advances of the industrial revolution were made possible, as James Beniger has pointed out, by new information technologies that permitted human beings to control mechanical processes.[4] The great advances in productivity during the 19th and early 20th centuries, however, lay in the harnessing of steam power and then internal combustion to industrial processes, and in the development of materials like coal and steel. Today, almost two-thirds of American GDP consists of services, and, with respect to much of it, manipulation of information is key. Even in manufacturing, services play an increasingly important role: the auto industry has achieved great increases in productivity as a result of improved information flows within and between organizations, such as those associated with lean manufacturing or the implementation of electronic data interchange systems. In saturated markets like North America, a car manufacturer cannot hope to increase revenues by selling substantially more cars but must add service-sector inputs to existing cars, in the form of greater safety features, intelligent navigation systems, higher reliability, and other improvements in quality.

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[3]For a description of the customer-driven marketplace, see Michael Hammer, *Reengineering the Corporation: A Manifesto for Business Revolution* (New York: HarperCollins, 1993), pp. 18–20.

[4]James R. Beniger, *The Control Revolution: Technological and Economic Origins of the Information Society* (Cambridge, MA: Harvard University Press, 1986), pp. 169–202.

Almost a decade ago, Peter Drucker coined the phrase "the information-based organization" to describe the kind of company that would emerge in such an environment. In his words, "the typical business [in 2008] will be knowledge-based, an organization composed largely of specialists who direct and discipline their own performance through organized feedback from colleagues, customers, and headquarters."[5] Under the old mass-production model, large numbers of relatively low-skilled workers were controlled by managerial hierarchies to produce large quantities of commodity-like products. The tools and capital goods, on the other hand, were highly complex and specialized; the intelligence of the organization in some sense lay in the way the production process was set up. Under the new, knowledge-based model, smaller numbers of highly skilled workers are used to produce a wide variety of highly complex and differentiated products and services, using more general-purpose tools and capital equipment.

ORGANIZATIONAL STRUCTURE: THREE PARADIGMS

The industrial revolution was not simply a matter of replacing human and animal power with steam power and mechanization. The full gains in productivity inherent in these new technologies did not occur until they were deployed in the appropriate form of organization.[6] Alfred Chandler has chronicled the rise of the hierarchical, multidivisional, professionally managed corporation as a critical element in the rise of 19th century economic powers like the United States and Germany.[7] It would seem likely that organizations will not achieve the productivity gains possible from contemporary information technology if they use it merely to automate existing

[5]Peter F. Drucker, "The Coming of the New Organization," *Harvard Business Review*, Vol. 66, No. 1 (January–February 1988), p. 45.

[6]On the general importance of organization to the economic development of the West, see Nathan Rosenberg and L. E. Birdzell, *How the West Grew Rich* (New York: Basic Books, 1986), pp. 189–241, 269–301.

[7]Alfred D. Chandler, *Scale and Scope: The Dynamics of Industrial Capitalism* (Cambridge: Harvard University Press/Belknap, 1990); and Chandler, *The Visible Hand: The Managerial Revolution in American Business* (Cambridge: Harvard University Press, 1977). For the classic definition of the modern corporation, see Adolph A. Berle and Gardner C. Means, *The Modern Corporation and Private Property* (New York: Macmillan, 1932).

processes in longstanding organizations; new forms of organization and completely redesigned processes will be necessary.[8]

The management literature of the past decade and a half has produced a variety of familiar buzzwords, including "downsizing," "rightsizing," "flattening," "reengineering," and "total quality management." Many of these concepts are nothing more than management fads, which often lead to more problems than they solve.[9] On the other hand, the magnitude of the productivity gains achieved in many cases suggests that some important insights are involved. Despite the variety of concepts, a broad theme runs through much of this literature, one that is related to the larger changes taking place in the U.S. and global economy. That theme has to do with information and how it flows through organizations. For what many managers have come to understand is that information, even within the boundaries of a single company, is not free, and that explicit attention must be paid to facilitating its flow. This, in turn, leads to changes in the way that authority is structured within the firm, to make sure that the necessary authority structures do not interfere with the flow of important information.

In the current management literature, business entities are grouped into three broad categories, according to their organizational structure:

- The traditional, hierarchical corporation
- The flat or virtual corporation
- The network organization.

Although these forms are capable of substantial variation and modification, they represent the past, present, and possible future of many commercial organizations.

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[8]On the importance of organization to military organizations, see James Q. Wilson, *Bureaucracy: What Government Agencies Do and Why They Do It* (New York: Basic Books, 1989), pp. 3–6, 14–18.

[9]For a skeptical view of some of the reengineering literature, see Thomas H. Davenport and Donna B. Stoddard, "Reengineering: Business Change of Mythic Proportions?" *MIS Quarterly* (1994), pp. 121–127, and Joseph B. White, "Re-Engineering Gurus Take Steps to Remodel Their Stalling Vehicles," *Wall Street Journal,* November 26, 1996, p. A1.

TRADITIONAL HIERARCHY

The traditional hierarchical organization was first developed in the United States in the late 19th and early 20th centuries as manufacturers and distributors sought to take advantage of economies of scale opened up by an expanding national market. The control structure for such an organization was the managerial pyramid illustrated in Figure 1, with responsibilities delegated downward through a number of echelons on either a geographical or functional basis.

The great theorist of the traditional hierarchical organization was the industrial engineer Frederick Winslow Taylor, whose book *Principles of Scientific Management* laid out the general principles underlying the organization of new mass-production facilities like Henry Ford's Highland Park, Michigan factory.[10] The Taylorite factory was based on an extensive division of labor, in which highly complex processes like automobile assembly were broken down into a series of simple steps through careful time-and-motion studies. The entire production process was strictly regulated through a centralized managerial

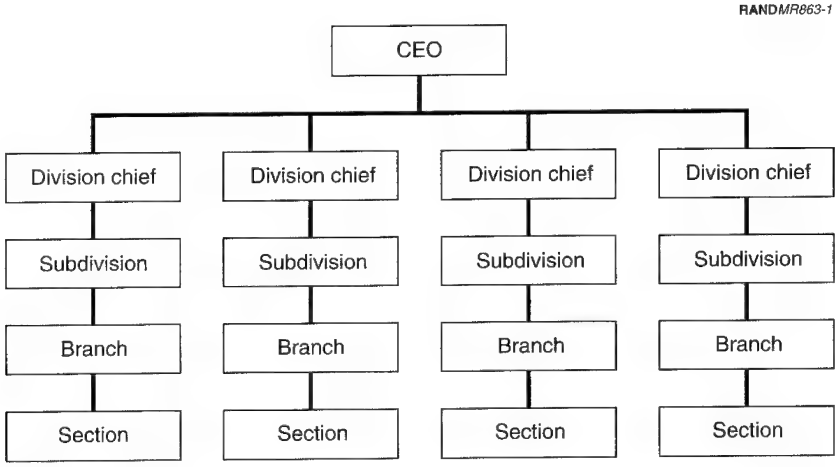

Figure 1—Traditional Hierarchy

[10]Frederick Winslow Taylor, *Principles of Scientific Management* (New York: Harper Brothers, 1911).

hierarchy, with white-collar engineers laying down elaborate rules to control the behavior of the blue-collar work force. One important objective of Taylorism was to simplify the production process sufficiently so that it could be carried out by poorly educated, first-time factory workers, who thereby could become interchangeable elements of the production process. It is interesting to note that some two-thirds of the workers at the Carnegie Steel Works in Pittsburgh in 1907 were immigrants, and that some fifty different languages were spoken at Ford's Highland Park facility in 1915.[11]

The Taylorite factory may be described as a "low-trust" workplace: individual workers at the bottom of the hierarchy were given little autonomy and were fenced in by detailed rules; it was assumed that they were motivated by relatively simple economic incentives.[12] In other words, management did not have to trust the workers to act autonomously in organizing or performing their tasks; unlike in the previous "craft" system, the worker was not assumed to possess the skills required to accomplish the work prior to his being shown what to do. Instead, the intelligence in the workplace was segregated in the managerial hierarchy, which determined the setup of machines, work flow, assignment of personnel, and so forth. Taylorite management in turn bred job-control unionism in the American labor movement. By midcentury the interaction of labor and management had created highly inflexible workplaces regulated by phonebook-length contracts detailing a complex set of work rules that sharply restricted the ways that workers could be moved or used on the shop floor.[13] This type of hierarchical organization was, nonetheless, effective in controlling large numbers of poorly educated workers,

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[11]See Allan Newis, Frank E. Hill: *Ford: The Times, the Man, the Company,* (New York: Scribner, 1954), p. 553; Womack et al. (1991), p. 31.

[12]William H. Davidow and Michael S. Malone, *The Virtual Corporation: Structuring and Revitalizing the Corporation for the 21st Century* (New York: HarperCollins, 1992), p. 107.

[13]The degree to which highly detailed rules are appropriate depends, of course, on the task at hand: the fact that airlines require pilots to work through a detailed checklist before takeoff doesn't imply that the airlines do not, in any ordinary sense of the term, "trust" their pilots. (Presumably, noncommercial pilots go through the same procedures even when flying for pleasure.) The issue of trust arises only when the purpose of the detailed rules is to try to ensure that neither party takes advantage of the other, e.g., to prevent workers from "slacking" or management from "sweating" the workers.

which was the challenge faced by the auto industry in the early 20th century. Organizing large numbers of poorly educated soldiers was also, it should be noted, the task faced by most early-20th-century mass-conscription armies.

FLAT OR VIRTUAL CORPORATION

Flat Corporation

In contrast to the traditional, hierarchical corporation, the flat or virtual corporation shifts authority downward and upward, or else pushes it outside the firm's boundaries. While flat and virtual might seem like rather different structures, they are essentially variants of the same strategy. As seen in Figure 2, the flat organization takes managerial authority away from one or more layers of middle managers and pushes it either down to the bottom of the organization or up toward senior management. The overall number of management layers decreases as a result: at Franklin Mint, it fell from six to four

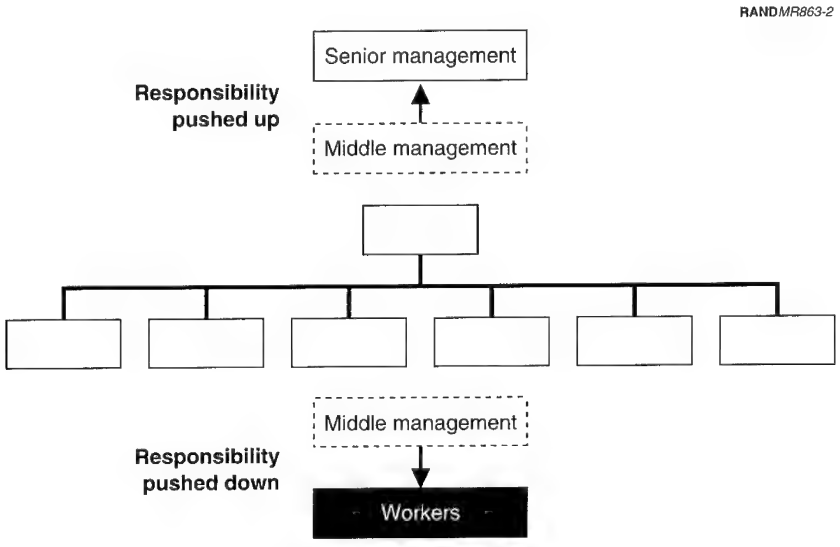

Figure 2—The Flat Organization

after a restructuring; at Kodak, the distance between manufacturing manager and factory floor fell from thirteen levels to four.[14]

The main advantage sought in flattening an organization can be understood in terms of information flows and costs. Traditional theorizing about organizations tended to assume that sharing information within the boundaries of an enterprise was cost free and automatic, and that it would flow rapidly without obstruction along the lines of authority as indicated on the firm's organization chart. In fact, information is costly to acquire and transmit; the process takes time and effort, and it is not free from error and distortion.

Information enters an organization at all points, and a great deal of local information comes in at the bottom (see Figure 3). There are obvious advantages to an organization that can process the latter kind of information close to its source. A more hierarchical organization, by contrast, requires that information entering at the bottom be passed up a multilayer managerial hierarchy for decision, and then back down again for action. The movement of information through a hierarchy does not just slow down the process; there is also

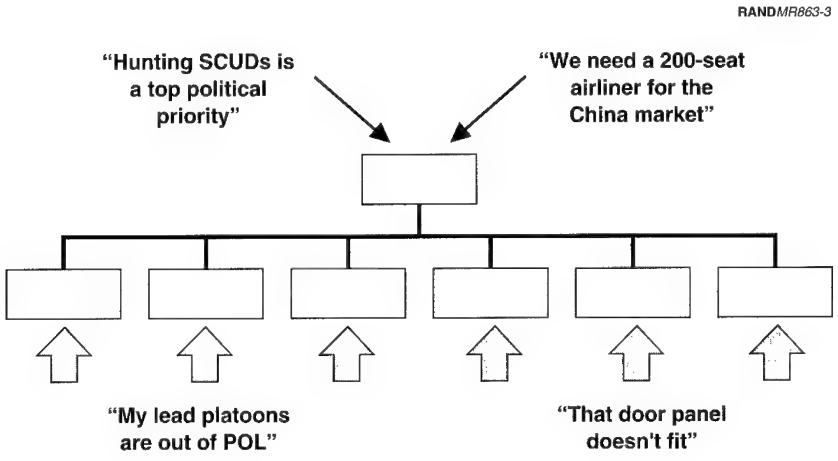

Figure 3—Information Flows Into an Organization

[14]Davidow and Malone (1992), p. 168.

a substantial risk that it will be distorted as it is handed off from one level to another. It is common in bureaucracies for each echelon to pass along only that information it thinks the next echelon above or below it needs or wants to hear. The result is necessarily an overall loss of information as it passes through the hierarchical sieve. In addition, there is an "agency" problem: each echelon in a hierarchy has its own bureaucratic interests and therefore may shape the information that it transmits to suit that interest. A highly centralized organization therefore creates the appearance of great control, but this is often an illusion because the center has a poor or distorted view of what is going on at the periphery.

It is not surprising, then, that many recent "reengineering" efforts have been directed at redesigning business processes so that information will be processed closer to the point where it is generated. In the words of Michael Hammer,

> Put the decision point where the work is performed, and build control into the process. In most organizations, those who do the work are distinguished from those who monitor the work and make decisions about it. The tacit assumption is that the people actually doing the work have neither the time nor the inclination to monitor and control it and that they lack the knowledge and scope to make decisions about it. The entire hierarchical management structure is built on this assumption . . . The new principle suggests that the people who do the work should make the decisions and that the process itself can have built-in controls. Pyramidal management layers can therefore be compressed and the organization flattened.[15]

The flat organization remains, nevertheless, hierarchical in the sense that senior managers still retain sovereign authority to control the behavior of their subordinates. With the elimination of middle managers, the span of control for senior management necessarily increases. James Bryan Quinn notes that in some service businesses, the span of control can range from 20–30 to hundreds of subordi-

[15]Michael Hammer, "Reengineering Work: Don't Automate, Obliterate!" *Harvard Business Review*, Vol. 68 (July–August 1990), p. 111.

nates, and that in these cases the term "span of control" is probably better replaced with a term like "span of communication."[16]

Indeed, moving to a flat organization can in some cases increase sharply the degree of centralization within the firm; what is critical is that managers understand what should and should not be centralized in this process. Despite talk about modern computer technology being necessarily democratizing, a number of important productivity-enhancing applications of information technology over the past decade or two have involved highly centralized data systems that are successful because all their parts conform to a single architecture dictated from the top.[17] For example, when Chrysler Corporation implemented its Supplier Delivery Schedule system, an electronic data interchange system, it forced all of its suppliers to conform to a single set of information exchange protocols based on ANSI X.12.[18] This system was needed to track parts for Chrysler's just-in-time inventory control system. Similarly, Hewlett-Packard replaced its highly decentralized procurement system, in which each of its 50 manufacturing units had its own purchasing department, with one in which a single corporationwide unit kept a centralized data base on vendors and their performance. This provided some economies of scale while still allowing the dispersed units to retain some flexibility in their ordering.[19]

In the 1980s, Federal Express implemented an ambitious package-tracking system for its entire delivery network: customers could tap into the company's data base and get information on the status of their particular shipments. Again, the information system making this possible required a substantial degree of centralization at the top in order to make it transparent to outside users.

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[16]James Bryan Quinn, *The Intelligent Enterprise* (New York: Free Press, 1992), p. 113. See also Davidow (1992), p. 169.

[17]One survey of empirical studies on how the introduction of information technology affects middle management finds that it is very inconsistent; some studies show declines in the ranks of middle managers, while others show increases. Alain Pinsonneault and Kenneth L. Kraemer, "The Impact of Information Technology on Middle Managers," *Management Information Systems*, Vol. 17 (1993), pp. 271–292.

[18]Tridas Mukhopadhyay, Sunder Kekre, and Suresh Kalathur, "Business Value of Information Technology: A Study of Electronic Data Interchange," *MIS Quarterly* (June 1995), pp. 137–156.

[19]Hammer (1990), p. 100.

The key point is that none of these systems could have "evolved" if individuals at lower levels of the organization had been free to go their own ways; unlike the situation in which an immediate problem can be best dealt with by the subordinate official on the spot, these innovations had to be mandated by senior managers with authority to enforce their decisions by fiat.

The famous Wal-Mart system of inventory control that allowed the retailer to eliminate several layers of hierarchy in its distribution network also involved the centralization of data resources. In contrast to a traditional retail distribution system (Figure 4), under the Wal-Mart system point-of-sale data from individual stores was sent automatically to a centralized server that kept track of sales, inventories, and suppliers for the whole corporation (Figure 5). The Wal-Mart system flattened the traditional hierarchy and distributed some of the prerogatives of middle management to individual stores (e.g., on how best to adapt to local conditions in marketing). On the other hand, the inventory control system realized huge efficiencies pre-

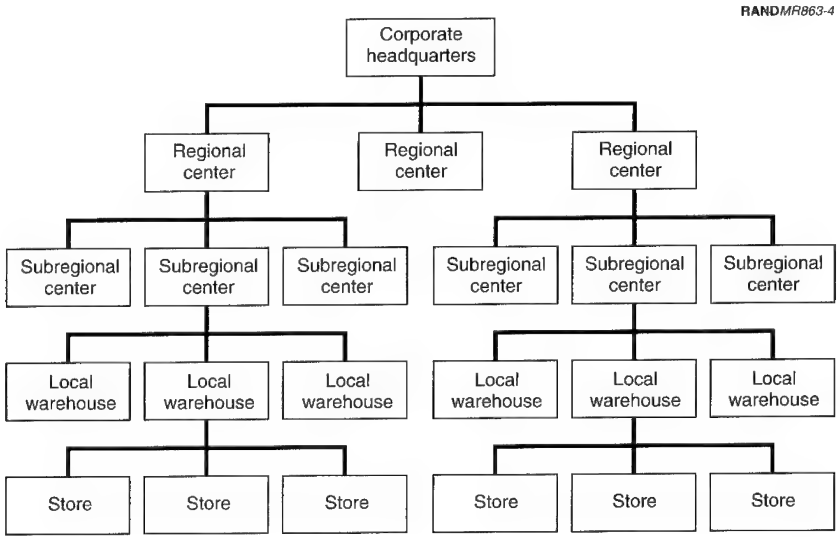

Figure 4—Traditional Retail Distribution

cisely because it was more highly centralized than the traditional hierarchical structure it replaced.[20]

Successful implementations of the flat organization concept depend critically on knowing which functions should be distributed and decentralized and which should be centralized and controlled from the top. Functions like purchasing and inventory control, which involve substantial economies of scale, are likely candidates for centralization, as are the settings of communications standards. (Note that the Internet itself could not have developed in the decentralized way it did were it not based on a single communications protocol, TCP/IP.) On the other hand, other decisions, such as when and how to market particular goods, or what kind of systems to procure to implement a given standard or protocol, are probably better left decentralized.

In contrast to the traditional Taylorite hierarchy, a flat organization requires a high degree of trust. In place of the machine-like mecha-

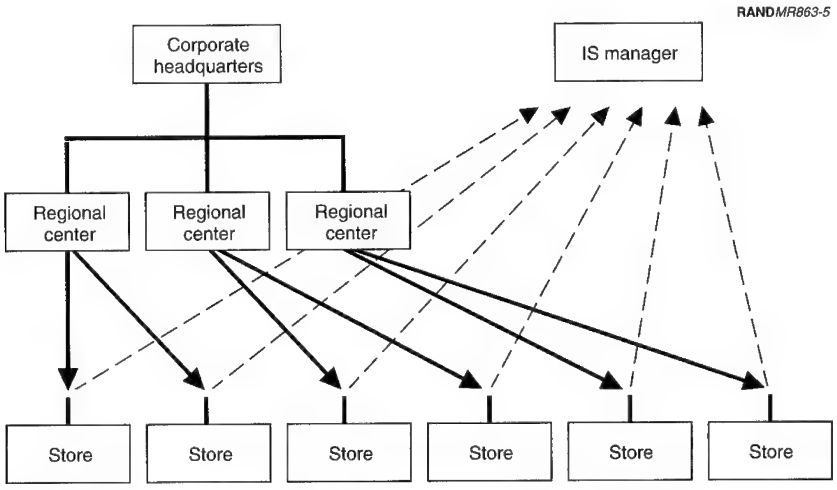

Figure 5—The Wal-Mart System

[20]George Stalk, Philip Evans, and Lawrence E. Shulman, "Competing on Capabilities: The New Rules of Corporate Strategy," *Harvard Business Review,* Vol. 70 (March–April 1992), pp. 57–69.

nism of the Taylorite factory, with its complex rules and regulations, a flat organization depends to some extent on workers themselves organizing their own activities. Decisionmaking on routine matters is, in other words, highly decentralized. For this reason, the move toward flat organization has been associated with the use of teams and quality circles, substituting the collective judgment of workers for the top-down authority of managers. Implementing this form of organization presupposes either a highly educated work force (organizations like hospitals and universities tend to have naturally flat management structures), or a substantial investment in training for less-educated workers. Managers obviously cannot devolve responsibility to the bottom layer of their organization unless workers at that level have the skills and training to make good decisions.

Virtual Corporation

The term "virtual corporation" does not have a single, agreed-upon meaning; management experts use it to designate everything from an "officeless" firm to a traditional company whose components are linked by an internal computer network. The most typical understanding is that the virtual corporation seeks to push as many routine functions outside the boundaries of its own organization as possible. The traditional understanding among economists of why firms tended to integrate a wide variety of functions under a single management structure had to do with transaction costs.[21] Contracting for goods and services through market interactions was frequently costly, particularly when complex, hard-to-evaluate goods and services were involved, so companies tended to bring these functions in house (see Figure 6) even though they were not able to perform them as efficiently as could others outside the company who specialized in these functions. With the introduction of cheaper, more sophisticated information technology, many of the costs of dealing across firm boundaries began to decline, becoming less than the costs associated with the inefficiency of producing a good or service in

[21]See Ronald Coase, "The Nature of the Firm," *Economica*, Vol. 6 (1937), pp. 386–405, as well as Oliver E. Williamson, "The Economics of Organization: The Transaction Cost Approach," *American Journal of Sociology*, Vol. 87 (1981), pp. 548–577, and Oliver E. Williamson and Sidney G. Winter (eds.), *The Nature of the Firm: Origins, Evolution and Development* (Oxford: Oxford University Press, 1993).

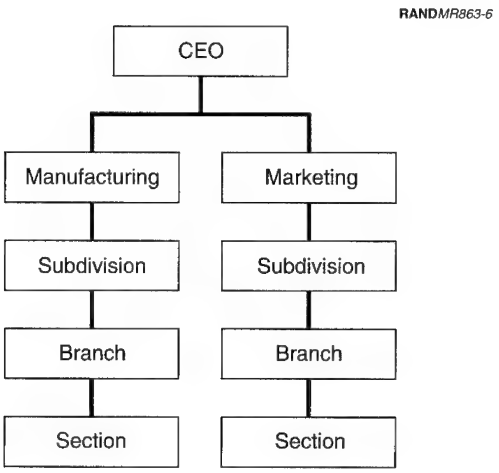

Figure 6—The Traditional Vertically Integrated Corporation

house.[22] It was for this reason that Thomas Malone suggested that one of the byproducts of the information revolution would be a general downsizing and breaking up of large, integrated corporations.[23] James Bryan Quinn advises companies to examine all of their activities and decide which constitute "core competencies" where they are "best in the world"; everything else ought to be outsourced to some other firm that is "best in the world" for the production of that good or service (see Figure 7).[24] He notes that many overhead expenses like personnel or accounting are in fact services that a company may not be particularly efficient at producing; anything that is either a commodity, or whose quality and value can be easily measured, is probably better done by someone else.

While moving to a "virtual" corporation might seem to be a substantially different strategy than flattening a managerial hierarchy, these

[22]Thomas W. Malone and John F. Rockart, "Computers, Networks and the Corporation," *Scientific American* (September 1991), pp. 128–136.

[23]Thomas W. Malone, Joanne Yates, et al., "Electronic Markets and Electronic Hierarchies," *Communications of the ACM,* Vol. 30 (1987), pp. 484–497.

[24]Quinn (1992), p. 32.

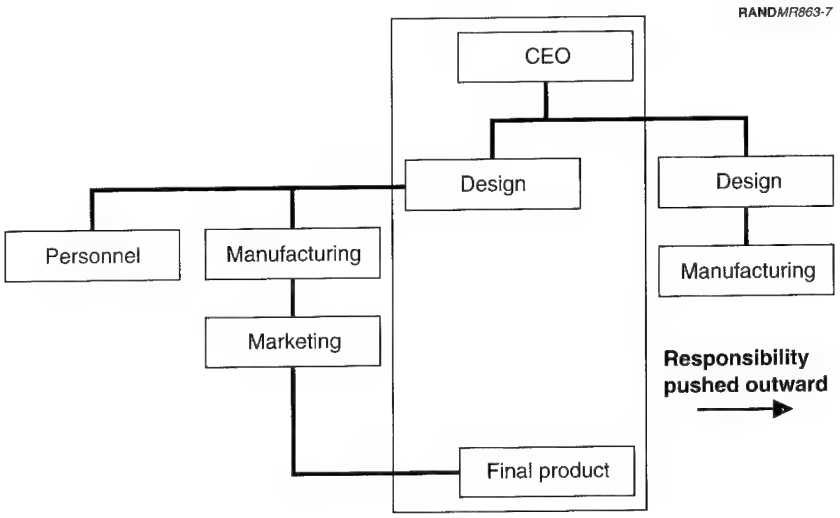

Figure 7—The Virtual Corporation

are actually variants of the same theme. Instead of pushing responsibility down, as in a flat organization, the virtual corporation pushes responsibility outward. The same relationships of trust that must exist between workers and managers in a flat organization are duplicated in the relationship between companies and their suppliers or subcontractors.[25] Many high-tech companies contract out not simply for commodity-like products, but for extremely sophisticated goods and services; a semiconductor company, for example, may only design the circuits and leave the actual wafer fabrication to a contractor. Clearly, this is not going to happen in the absence of a considerable degree of trust between company and contractor.[26]

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[25]Charles Handy, "Trust and the Virtual Organization," *Harvard Business Review*, Vol. 73, No. 3 (May–June 1995), pp. 40–50.

[26]Davidow and Malone (1992), pp. 151–152.

NETWORK

The third form of organization is the network, which carries the elimination of hierarchy one degree further.[27] As illustrated in Figure 8, the network has no sovereign source of authority; all of the members of the organization cooperate with one another on a more or less equal basis. Many nongovernmental organizations are organized in this fashion. In the commercial world, the Internet and the Visa credit card system are prime examples of this sort of headless, bottom-up organization. A number of authors have noted that many biological systems are organized in this kind of decentralized manner; a swarm of bees and the human brain itself have no controlling centers, but rather exhibit complex behavior that "emerges" out of the behavior of the thousands of simple agents that constitute them. The new science of "complexity" seeks to understand the behavior of such "complex adaptive systems" in a systematic fashion.[28]

The great advantage of highly decentralized organizations lies in their adaptiveness. In a rapidly changing and uncertain environment, constant experimentation and change are necessary. A network consists of hundreds or thousands of individual agents trying to adapt to their local conditions; if it functions properly, it has a mechanism for sorting out the helpful from the hurtful adaptations and propagating the former through the rest of the swarm. The ruthless process of natural selection can be understood as a learning mecha-

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[27]This form of organization has been described variously. See Shumpei Kumon, "Japan as a Network Society," in Shumpei Kumon and Henry Rosovsky (eds.), *The Political Economy of Japan, Vol. 3: Cultural and Social Dynamics* (Stanford: Stanford University Press, 1992); David Ronfeldt et al., "Restructuring Civil Society Across North America in the Information Age: New Networks for Immigration Advocacy Organizations" (unpublished RAND research, 1993); David Ronfeldt and Cathryn L. Thorup, *North America in the Era of Citizen Networks: State, Society, and Security* (Santa Monica, CA: RAND, P-7945, 1995); and Valdis Krebs, "Visualizing Human Networks," *Release 1.0* (12 February 1996), pp. 1–25.

[28]This approach has been supported by research sponsored primarily by the Santa Fe Institute. On the general background of adaptive systems, see M. Mitchell Waldrop, *Complexity: The Emerging Science at the Edge of Order and Chaos* (New York: Touchstone/Simon and Schuster, 1992), pp. 99–135, and John Holland, *Hidden Order: How Adaptation Builds Complexity* (Reading, MA: Addison-Wesley, 1995), pp. 1–40. On the organic metaphor in information systems, see Kevin Kelly, *Out of Control: The New Biology of Machines, Social Systems, and the Economic World* (Reading, MA: Addison-Wesley, 1994), pp. 5–28.

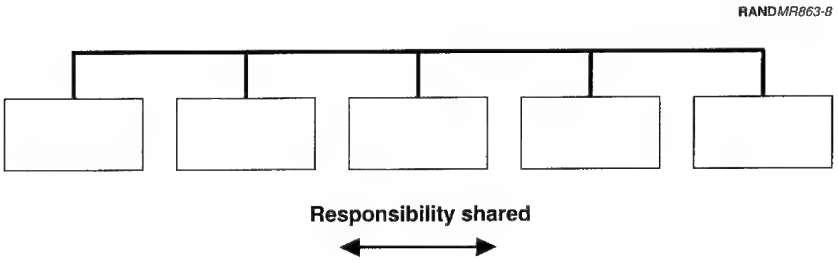

Figure 8—The Network

nism that weeds out bad alternatives and propagates good ones through the population's gene pool.

CENTRALIZED VERSUS DECENTRALIZED ORGANIZATIONS

So far the discussion has concentrated on issues of organizational structure, dividing organizations into three ideal types: hierarchical, flat/virtual, and network. Another perspective on organizational differences would look at where authority resides within the organization: in this sense, there is a continuum in organizational character from highly centralized to highly decentralized. It is possible to mix centralized and decentralized elements in the same organization; thus, certain functions enjoying significant economies of scale (e.g., purchasing) may be centralized, while others needing localized decisionmaking (e.g., marketing) may be decentralized. In general, there are certain tradeoffs that characterize organizations as they move from one pole to the other, summarized in Figure 9.[29] Below we discuss each one's theoretical advantages and disadvantages.

Advantages of Centralization

The current enthusiasm for the network form of organization in certain management circles implies an enthusiasm for decentralization

[29]For a similar listing of advantages and disadvantages of decentralized organizations, see Kelly (1994), pp. 21–25.

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Centralized	Decentralized
• Advantages – Speed – Efficiency	• Advantages – More adaptive – More resilient
• Disadvantages – Brittleness – Sclerosis – Routinization – Risk (long run)	• Disadvantages – Hard to control – Unpredictable – Risk (short run)

Figure 9—Centralized and Decentralized Organizations

that is probably misplaced or at least exaggerated. Centralized organizations have evident advantages with respect to speed and decisiveness. If the organization has a clear-cut goal and has to move quickly to achieve it, then some degree of hierarchical control will be critical. An Army planning a surprise attack, or a corporation like Intel or Boeing that periodically has to make large, risky investment decisions that "bet the firm," will not benefit from decentralized control over these decisions. The few examples of successful network organizations like the Internet or Visa never have to do anything as organizations; they rather constitute a framework within which their individual members can operate. Organizations without clear-cut sovereign authority may be paralyzed by internal disagreements, and they can be slower to act than their more centralized counterparts.

Centralized organizations can more readily take advantage of scale economies. Purchasing and distribution systems, for example, usually benefit from being large. Organizations with uniform standard operating procedures are more readily scaleable: one of the reasons that the U.S. Army emphasized uniformity in training, equipment, and doctrine was its belief that it was primarily a mobilization base that would have to be rapidly expanded in wartime.

Decentralized organizations entail a higher degree of risk, at least in the short run. Any organization that pushes responsibility down to the bottom layer, or outward to suppliers and subcontractors, must expect that lower-level employers, or outsiders, will occasionally make mistakes that higher-level officials might have avoided; while commercial organizations that do so can reap great efficiency rewards, they also have to accept a higher level of day-to-day mistakes and problems. Indeed, it is precisely short-run failure that often drives institutions to implement centralized controls. The history of U.S. government procurement is one such case: if purchasing authority is devolved, there will over time be serious errors of judgment and even cases of corruption, leading to the imposition of new auditing requirements and management controls.[30]

Advantages of Decentralization

On the other hand, decentralized organizations have certain key advantages. They are usually far more resilient than centralized ones. A centralized army (like that of the Iraqis, or their Soviet mentors) could easily be paralyzed by taking out its command and control; a more decentralized army (like the German army in World War II) could keep fighting even when decapitated. A highly centralized, regulated system can be fine tuned for efficiency in the short run, but when conditions change, the entire structure runs a greater risk of breaking. Centralized controls put a floor under behavior and constitute some guarantee that short-run mistakes can be kept under control. On the other hand, the rule-bound nature of centralized control also tends to put a ceiling on performance, failing to permit members of the organization to take risks and to make the kind of mistakes that result in learning.

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[30]This is, of course, not to say that a more centralized procurement system is to be preferred: the costs of centralization (e.g., in terms of delay and inflexibility, as well as the actual operating costs of the auditing and control bureaucracies) may well outweigh the costs associated with the occasional mistakes or corruption arising from decentralization. As noted in a study of defense procurement practices, "Across-the-board demands for information to document contract price—without regard to the direct and indirect costs of requiring the information—may well defeat the original intent of the controls." *Integrating Commercial and Military Technologies for National Strength: An Agenda for Change,* Report of the CSIS Steering Committee on Security and Technology, prepared by Debra van Opstal, Project Director (Washington, D.C.: Center for Strategic and International Studies, 1991), p. 39.

Thus, a decentralized organization may be better able to adapt to new circumstances. The diffusion of authority means that many different individuals or units are able to experiment with new ideas and try new methods: such an organization is better situated to "let one hundred flowers bloom." As a result, useful means of coping with new circumstances are more likely to be discovered. Assuming that internal communications are adequate, any such new techniques can be disseminated to the rest of the organization.

Degree of Centralization Depends on the Task

The risks run by centralized organizations, then, are very different from those run by decentralized ones. Short-term performance is always likely to be better, assuming that the management hierarchy has adequately structured the organization to its current environment and implemented the proper controls over behavior; long-range adaptation, however, is likely to be inadequate and the firm may face sclerosis.

Which of these risks is the more serious depends on what kind of activity the organization is engaged in, and how clear-cut its goals are. If the goal is to invade Normandy on June 6, 1944, or to put an American on the moon by the end of the decade, then a high degree of centralization will be required to mobilize the group's resources to achieve the defined objective. If, on the other hand, the goal is more diffuse—for example, to make new products for the wireless PCS market or to develop forces and doctrine to meet the threat environment of the early 21st century—then a more decentralized organization will have distinct advantages. Problems arise when organizations must do both simultaneously, for example, carry out short-term operations demanding a high degree of centralized command-and-control *and* plan for a long-range future. The risk is that the structure for one activity will be the structure used for the other as well.

The tradeoffs between centralized and decentralized decisionmaking can be seen in the longstanding policy issue of Marine Corps aviation. The fact that the U.S. Marine Corps operates what amounts to its own specialized air force has always been a matter of controversy, particularly to budget-conscious officials in the Office of the Secretary of Defense. For the Marines to operate their own aircraft in

relatively small numbers makes no sense from an efficiency standpoint; much better to turn over the close air support mission to the Air Force or Navy. On the other hand, the fact that the Marines operate their own air assets is much better from the standpoint of adaptation, in both the short and long run. In combat, the Marine Air Wings give the Corps some confidence that it can control its own air support;[31] over the longer term, it allows the Marine Corps to develop aircraft uniquely suited to its specialized amphibious operations. Whether these "adaptive" capabilities outweigh their costs from a joint perspective is a complicated issue, but the example highlights some of the advantages and disadvantages of decentralized procurement.

In considering corporate models relevant to the military, we will focus primarily on flat organizations, or else organizations that combine some degree of flatness with some traditional hierarchy. It seems unlikely that any military organization could ever be organized in a true network fashion, given operational requirements for speedy and decisive action. The model of the virtual corporation, with extensive outsourcing, is of some relevance to the military, particularly in areas like procurement, logistics, and other forms of noncombat service support. The virtual model would seem to be of limited applicability in the actual combat arms, however; it would seem unlikely that the U.S. Army would ever contract out for its fire support simply because the British or French armies could do it more cheaply.

Networks as Informal Linkages

There is, however, another way of thinking about networks that divorces the concept from any specific form of organizational structure, and defines a network rather as an *informal* community of individuals who share common norms or values and thus interact with one another on a nonmarket basis. Networks can be based on many different kinds of norms or values, from religion, ethnicity, professional training, common schools or employers, to simple friendships.

[31]Subordination of Marine Corps air to the Joint Force Air Component Commander (JFACC) during the Gulf War was, naturally, a source of considerable controversy.

People within such networks share information more readily than those with no common norms or values; friends, for example, do not demand payment for information but exchange it reciprocally in proportion to the strength of their friendship.

Understood in this fashion, networks are not an alternative to hierarchies but rather are typically overlaid on top of formal organizations, and they are frequently critical to the latter's proper functioning. That is, a company can have a formal hierarchical structure but it can also have a common corporate culture (e.g., the "HP way" at Hewlett Packard) that defines a set of norms that every employee, regardless of rank, is expected to exhibit.[32] Many networks are exogenous to formal organizations—based, for example, on the fact that a company's engineers went to engineering school with one another or belong to the same church. A majority of the semiconductor firms in Silicon Valley were spinoffs of Fairchild Semiconductor; the executives of successor firms like Intel or National Semiconductor were members of a common network due to the social relationships developed at Fairchild. Annalee Saxenian attributes the success of Silicon Valley as a regional cradle of technological innovation to the fact that it, in contrast to Boston's Route 128 area, was criss-crossed by a dense set of social networks that permitted the easy flow of ideas and intellectual property across organizational boundaries.[33]

Understood in this sense, informal trust networks play an important function in formal organizations by facilitating the flow of information through them. A manager in marketing may have a friend or college acquaintance in purchasing; a single phone call between them short-circuits the formal hierarchy and speeds up the delivery of a needed item. In high-tech product development, such informal networks were crucial to the dissemination of innovations throughout a regional economy. It is important to note that in Silicon Valley, these informal networks frequently transcend the boundaries of formal organizations; indeed, one of the weaknesses of Route 128 firms

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[32]On the question of "organizational culture," see Edgar Schein, *Organizational Culture and Leadership* (San Francisco: Jossey-Baas Publishers, 1992).

[33]Annalee Saxenian, *Regional Advantage* (Cambridge: Harvard University Press, 1991), Chapter 2.

was an internal culture that discouraged the sharing of ideas and technologies with outside companies.[34]

As the phrase "old boy network" suggests, informal trust networks are nothing new, and they can frequently be harmful to the proper functioning of an organization. Networks facilitate information flow among network members but can impede such flow beyond network boundaries. A patronage network can foster jealousy and charges of nepotism. Functional divisions within large organizations often develop their own branch cultures, which then serve to block cooperation and information sharing between branches. Ideally, then, one wants a formal organization that is overlaid with a high density of different, cross-cutting networks: not simply a single organizational culture, but other "cultures" that promote the horizontal flow of ideas and people between branches, divisions, and across the external boundaries of the organization.

FLAT ORGANIZATION IN PRACTICE: LEAN MANUFACTURING

To illustrate how organizational flattening has worked in real-world corporate environments, we will consider the case of "lean" manufacturing in the automobile industry. Lean, or "just-in-time" production (*kanban* in Japanese), was a production method developed by an industrial engineer, Taiichi Ono, at the Toyota Motor Corporation in the 1950s. Originally conceived as a way of getting around Toyota's lack of expensive capital equipment, lean manufacturing has been generalized into a production method of wide applicability in a variety of different sectors. Lean production has led to astounding gains in those automobile factories where it has been adopted, and it accounted for Toyota's early advantages over its better-established U.S. competitors in the 1970s and early 1980s in terms of quality and price. According to the MIT Motor Vehicle Study, among North American plants that introduced lean manufacturing during the 1980s, productivity per worker increased.[35] These striking gains

[34]Saxenian (1991), Chapter 3.

[35]For example, the GM New United Motor Manufacturing Inc. (NUMMI) plant in Fremont, California, which introduced lean manufacturing techniques in the early 1980s, achieved a productivity level of 19 worker-hours per car, compared with 31

in productivity ensured that lean manufacturing would be adopted not just elsewhere in the auto industry, but in many other industries as well.

Lean manufacturing represents a major break from the Taylorite form of organization described above, which was prevalent in the U.S. auto industry since the first decades of the 20th century. Rather than segregate managerial functions in the white-collar staff, lean manufacturing pushes the authority for routine functions, like setting up the production line and scheduling work, down to the factory floor itself, making extensive use of teams to organize labor. Production is extremely flexible; within teams, workers can be moved from one job assignment to another as the need arises. Workers are encouraged to help tweak the production process; Toyota's Takaoka assembly plant implemented the famous cords at each workstation by which each assembly line worker could stop the entire production process if he saw a problem.

As its name implies, lean manufacturing reduces the amounts of inventories and buffers used in the production process, and it schedules deliveries from suppliers and subcontractors so that they arrive just before they are needed. This stands in sharp contrast to the traditional Taylorite factory, which put a premium on maintaining substantial buffers to prevent a shutdown of the production line when the inevitable problems occurred. Many observers misunderstand the use of inventories in lean production, assuming that its purpose is simply to lower inventory carrying costs. While this constitutes an additional advantage, the real ingenuity of this system is to create a strong set of incentives for managers and workers to act on the information they have about the production process.

The essence of lean production is to deliberately create an extremely fragile production process that serves as an information feedback loop by which problems can be caught at the source. For example, if an assembly line worker tries to bolt on a door panel that does not fit correctly on the chassis, the entire assembly line must cease production until the door panel supplier corrects the defects in his shipment. While this slows initial production, it gives managers a strong

hours at GM's traditionally managed Framingham, Massachusetts plant. Womack, Jones, and Roos (1991), p. 83.

incentive to fix the problem at its source rather than pass it down the line. In a traditional Taylorite factory, the poorly fitting door panel would be discarded, or bolted on nonetheless, in hopes that any quality problems would be caught in the rework area at the end of the line. It is obvious why lean assembly plants had much better records in manufacturing quality than their Taylorite counterparts.

The central lesson from lean manufacturing critical for flat organization is the question of incentives. Lean manufacturing can simultaneously achieve higher quality *and* lower production costs not simply because information on problems exists, but because the system is structured to give everyone an incentive to act on that information.[36] After all, in a traditional auto plant, the assembly line worker had the same information about a poorly fitting door panel; what he, or his supervisor, did not have was a strong motive to make sure that the subcontractor fixed the problem before continuing the assembly process. By allowing the entire production process to come to a halt over small problems, lean manufacturing ensures that the information on the door panel will flow quickly from the shop floor to the purchasing department.

Lean manufacturing is not a technique that can be readily applied to a military organization. Obviously, buffers and safety margins are critical in military operations; shutting down the production line temporarily does not entail the same degree of risk as shutting down a division's operations. The lessons to be derived from this example are twofold: first, a properly designed flat organization will authorize those parts of the organization closest to the source of information to act on it; second, incentives have to be structured in such a way that those lower parts of the organization with authority actually exercise it. Those principles, when applied correctly, can yield tremendous benefits in terms of efficiency of operation.

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[36]Since this discussion focuses on lean manufacturing, it ignores other sources of increased quality and lower production costs in the automobile industry, such as an improved design process that pays more attention to manufacturability from the outset.

Chapter Two

THE MILITARY AS A FLAT ORGANIZATION

It is typical to think of modern armies as prototypical Taylorite, hierarchical organizations. The modern mass-mobilization army was created during the Napoleonic era, just at the time that the factory system was being established in the textile industries of England and the United States, and a generation before the construction of railroads. Over the next two hundred years, there were many parallels between military and industrial organization. Both military and industry faced similar problems of controlling large numbers of personnel and synchronizing their activities through a vast managerial hierarchy. During the Civil War, the U.S. Army was the largest single organization in the United States. A generation later, it had been eclipsed by private industry: by 1891, the Pennsylvania Railroad had over 110,000 employees, while the U.S. Army had 39,492 men under arms.[1] At times, commercial organizations appeared to borrow military concepts of bureaucracy, ranks, and staff; at others, the military made use of industry's "scientific management principles."

Of course, armies, especially modern ones, are very complex organizations. In addition to the noncombat functions they perform during combat (including logistics, communications, medical support, etc.), they must maintain vast organizations to perform a variety of "peacetime" activities, such as the research and development (R&D) leading to new weapons systems, procurement of those systems,

[1]Alfred D. Chandler, Jr., *The Visible Hand: The Managerial Revolution in American Business* (Cambridge: Belknap Press of Harvard University Press, 1977), pp. 204–205.

recruitment and training of personnel, and the development of doctrine for the conduct of future combat. In this chapter we discuss the organization of armies for combat in an historical context. Issues related to the other functions are discussed in the following chapter, which deals with implications for the U.S. Army.

It would not occur to many people to think of military organizations as pioneers of flat organizations, teams, and other trendy management concepts of the late 20th century. But in fact, some of the world's better armies put these concepts into practice in combat long before they were promoted by management consultants and implemented on factory floors. The reason is related to the central problem of information: when actually engaged in combat, military organizations to an even greater degree than commercial ones have to deal with problems of inadequate information, and to deal with them they have implemented flat command-and-control mechanisms.

Officers working in military hierarchies have long understood that information passing up and down command echelons can be delayed, distorted, and filtered in all sorts of unexpected ways that frequently impair military effectiveness. As one author notes,

> In a hierarchical organization, authority is delegated to subordinate commanders to take action within some area of discretion . . . On the assumption that the amount of real control by each echelon is somehow related to the amount of information there, some subordinate commanders avoid sending up unevaluated information and send only what they believe their seniors want to hear. They are concerned that as more information goes up, less authority will he delegated downward.[2]

Due to the reluctance of subordinate commanders to pass on unfiltered information in a rapid manner, senior commanders are fre-

[2]Frank M. Snyder, *Command and Control: The Literature and the Commentaries* (Washington, D.C.: National Defense University Press, 1993), p. 33. S. L. A. Marshall makes a similar point: "Commanders at the lower levels tend to be the arbitrary judges of what information deriving from a source lower down would be highly useful to the other elements lower down instead of abiding by the rule: when in doubt, pass it along." *Men Against Fire: The Problem of Battle Command in Future War* (New York: William Morrow and Co., 1947), p. 93.

quently induced to use "directed telescopes"—channels outside the formal command structure—that permit information to skip echelons and pass directly to the center.

Similarly, effective military operations depend as well on a dense flow of lateral communications between units that bypasses the vertical channels of authority. In his classic study *Men Against Fire*, S. L. A. Marshall observes:

> It is true that we have worked marvels in furthering the rearward flow of information to higher headquarters. When a small and highly mobile force of men seized the bridge at Remagen the fact was known to the Supreme Commander, then at Rheims, within the hour . . . The rub comes of this—that in all probability it will not become known to other companies within that same battalion in the course of the same day, if at all. Yet these are the people to whom the information would be most useful. We can look briefly at a few of the reasons for this pervading contradiction: (1) *There is lacking a general recognition of the supreme importance of the lateral flow of information.*[3]

Marshall notes that military effectiveness is entirely dependent on unit cohesion, which in turn is a function of the degree of horizontal communications between the individuals who make up the unit. Without that flow of information, the unit becomes a mass of uncoordinated individuals without the moral will or tactical intelligence to support one another; with information, they become a mutually supportive social unit much more powerful than the sum of their individual abilities. While necessary for strategic command functions, hierarchies in battle can be great hindrances; flat organizations are dictated by the immediate information needs of combat.

HISTORICAL CASES: NAPOLEON

There are numerous historical examples of flat combat organizations. Martin Van Creveld argues that Napoleon's single most important military innovation was the development of a modern command organization that allowed him to control forces far larger than

[3]Marshall (1947), p. 92 (emphasis added).

anything fielded in the preceding centuries of warfare.[4] This could only be done through the creation of a very flat organization that divided the *Grand Armée* of perhaps 150,000 men into a number of independent corps and, below that level, divisions. These corps unified all combat arms and could take care of their own logistics, allowing them to operate with considerable autonomy. Each was designed to be interchangeable with the others and was led by one of Napoleon's trusted marshals. Davoût, Ney, Augereau, Bernadotte, and the other officers who led these corps were all highly capable soldiers used to independent action and jealous of their command authority.[5] The corps and divisions for the first time had their own well-organized general staffs, 16–24 officers in the case of the corps and 11 for the division.[6]

The French army at the time of the battle of Jena-Auerstädt in 1806 was astonishingly flat: in contrast to the three-unit span of control typical of many armies, Napoleon's headquarters controlled *eight* independent corps with no intermediate command echelon.[7] The flatness of the overall organization accounts for the extreme speed with which it could move; not having to pass through a series of intermediate echelons, a corps could respond to an order from Napoleon's headquarters to move as many as three times in a 24-hour cycle.[8] On the crucial day of the battle of Jena, Napoleon failed to give orders to two of his eight corps, with whom he had very spotty contact. This failure to direct from the center did not have serious consequences because of the decentralized decisionmaking structure built into the organization. Indeed, it was only after the battle of Jena that Napoleon learned that Davoût's 3rd Corps had beaten the main Prussian army at Auerstädt, completely without his knowledge.

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[4]Martin Van Creveld, *Command in War* (Cambridge, MA: Harvard University Press, 1984), pp. 58–62.

[5]Indeed, their independence was something of a problem for Napoleon, as none of them were willing to serve under the command of any of the others.

[6]Van Creveld (1984), pp. 72–73.

[7]There is some evidence that it required a Napoleon to make such a system work. During the Franco-Prussian War, Napoleon III also organized his army into eight separate corps with no intermediate command echelon and found the span of control much too broad. See Arthur T. Coumbe, "Operational Command in the Franco-Prussian War," *Parameters*, Vol. 21, No. 2 (Summer 1991), pp. 87–99.

[8]Van Creveld (1984), pp. 87–88.

It should be noted that Napoleon created a flat organization, and not a network organization. As noted in the previous chapter, flat organizations eliminate middle management layers by sending some authority down to subordinate echelons while sending other types of authority upward, decentralizing and centralizing at the same time. This was very much true for Napoleon: his headquarters intervened in the affairs of individual divisions and even regiments, bypassing the authority of the corps commanders. Indeed, a number of critics blamed Napoleon for running an overcentralized organization.[9] This was not true of his command style as a whole; as noted above, he was able to let entire corps direct themselves for extended periods. Napoleon made use of a "directed telescope." The secret to making a flat (as opposed to decentralized) organization work properly was to use the directed telescope judiciously. If abused or utilized when more arm's-length methods were available, it could be an oppressive source of micromanagement; used properly, it could achieve fast and decisive results. Napoleon's military genius lay, in part, in his ability to know when to intervene and bring the full authority of his central headquarters to bear, and when to back off and let his command system run itself autonomously. This is not different in essence from the problems facing those designing and directing contemporary flat organizations.

HISTORICAL CASES: THE GERMAN ARMY

It was the Germans, however, who in the 20th century took the concept of flat military organization and developed it into a coherent doctrine of maneuver warfare, a doctrine that has been widely copied and applied by other armies including that of the United States. The tradition of decentralized command and independent action within the German military has a long pedigree. Although Prussian society was rigidly stratified and developed a reputation of being one in which blind obedience to orders and authority was prized, the reality of social relations within the military was somewhat different. A number of foreign observers have noted over the years how Prussian officers, while possessing great authority, tended not to stand on rank to any great degree, and encouraged an egalitar-

[9]Van Creveld (1984), p. 98.

ian sense of independence among junior officers. In 1860, one Prussian field marshal wrote:

> It seems that among the Prussian officers there developed an unusual feeling of independence towards superiors and a readiness to accept responsibility as can be found in no other army. The Prussian officers would not suffer restrictions by rules and regulations as are customary in Russia, Austria, England.[10]

In a similar vein, a French lecturer after the Franco-Prussian war told his students:

> Common among the [German] officers was the firm resolve to retain the initiative by all means . . . NCOs and soldiers were exhorted, even obligated to think independently, to examine matters and to form their own opinions. These NCOs were the backbone of the Prussian army.[11]

The relatively egalitarian relationships among officers, noncommissioned officers (NCOs), and enlisted men paralleled similarly communal relationships[12] on the German factory floor, where the *Meister* (foreman, comparable to an NCO) and his subordinates were not separated by status distinctions to the same degree as their French or British counterparts.[13] These examples are important insofar as they indicate that decentralized command initiative of the sort encouraged in flat organizations is in some measure a matter of culture, and depends on the existence of a sense of community among leaders and led.

This German tradition of independent action on the part of junior officers facilitated the practice of *Auftragstaktik,* or mission orders—

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[10]Quoted in Franz Uhle-Wettler, "*Auftragstaktik:* Mission Orders and the German Experience," Richard D. Hooker, Jr. (ed.), *Maneuver Warfare: An Anthology* (Novato, CA: Presidio Press, 1993), p. 241.

[11]Ibid.

[12]On this point, see Christopher Bassford, "Cohesion, Personnel Stability and the German Model," *Military Review,* Vol. 70, No. 10 (1990), pp. 73–81.

[13]On German workplace relations, see Francis Fukuyama, *Trust: The Social Virtues and the Creation of Prosperity* (New York: Free Press, 1995), pp. 231–243, and Marc Maurice, Francois Sellier, and Jean-Jacques Silvestre, *The Social Foundations of Industrial Power: A Comparison of France and Germany* (Cambridge: MIT Press, 1986).

that is, short statements of the commander's intent that provide broad strategic direction to subordinates while leaving detailed execution up to lower levels of command. This was already being practiced by the German General Staff during the Franco-Prussian War; one directive guiding the movements of the Army of the Meuse and the Third Army (a force of 200,000 men) for four days was formulated in less than a page of text.[14]

The idea of decentralizing command authority to lower-level units arose once more during World War I as the German General Staff faced the problem of how to break the deadlock in trench warfare. Its solution was the creation of *Stürmtruppen*, or storm trooper battalions, independent units trained to operate autonomously to find weak spots in enemy defensive lines. Instead of being integrated into large, scripted, methodical assaults over a broad front, the storm trooper battalions were ordered to infiltrate enemy trench lines and attack strong points from the flank and rear. Rather than relying on prolonged artillery barrages controlled at the army level, the units were supported by shorter barrages (in part, so as not to give away the direction of the main offensive) and were equipped with two organic batteries of light, direct-fire artillery that could be moved over the battlefield by the assault units themselves.[15] In the words of a training directive prepared in early 1918, "Everything depends on a rapid advance, carried out by the leading troops in the certainty that flank and rear protection, as well as fire support, will be taken care of from behind... Everything depends on rapid, independent action by all headquarters within the framework of the whole, and also on the ability of the artillery and ammunition supply to keep up."[16] Units were encouraged to maintain the momentum of the offensive at all costs, accepting the likelihood that lines would lose their cohesion in a chaotic battlefield.

In addition to the specific innovation of storm trooper battalions, the German army experimented incessantly during World War I with different organizational forms. In 1916 it eliminated the brigade

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[14]Coumbe (1991), pp. 92–93.

[15]Larry H. Addington, *The Blitzkrieg Era and the German General Staff, 1865–1941* (New Brunswick, NJ: Rutgers University Press, 1971), pp. 25–26.

[16]Quoted in Van Creveld (1984), pp. 174–175.

echelon in favor of infantry divisions consisting of three infantry regiments. In addition, it streamlined the corps headquarters, devolving responsibility to the commander of engaged forces and maintaining the corps largely as a support echelon.[17]

Storm trooper battalions were created as early as 1916 and were from the first regarded as elite units. The assault battalions were given intensive training in infiltration tactics and independent operations, and they were rewarded with special rations, insignia, and relief from routine assignments.[18] They were used first at Riga on the eastern front and at Caporetto in Italy in 1917. In November 1917 they were used in the counterattack against the British offensive at Cambrai, which saw the first use of tanks to break the trench warfare deadlock. They were so successful in driving back the British that Ludendorff, the German commander, decided to make them the centerpiece of his major spring offensive the following year. The Ludendorff offensive that began on March 21, 1918, saw the Germans drive the British back on a broad front. The offensive achieved striking tactical gains in its first few days and, before stalling out by April 5, for a while appeared likely to split the British and French armies. The contrast between German and British tactics is indicated by the following passage:

> The Eighteenth Army captured 7000 prisoners on the first day... This haul of prisoners gives some indication of the effect that the German tactics had on the British and Portuguese defenders. Completely untrained for independent action, small units were isolated psychologically by the bombardment and physically by the "infiltration" of the stormtroopers between strong points.[19]

The Ludendorff offensive ultimately failed, as did two further attempted German offensives on the western front in 1918, and their

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[17]Timothy T. Lupfer, *The Dynamics of Doctrine: The Changes in German Tactical Doctrine During the First World War* (Fort Leavenworth, KS: The Leavenworth Papers, No. 4, 1981). Lupfer notes that "The Germans began the war with an infantry division that had two infantry brigades of two infantry regiments each. A reorganization begun in 1916 on the western front eliminated the brigade structure and created a division with three infantry regiments" (p. 16).

[18]Bruce I. Gudmundsson, *Stormtroop Tactics: Innovation in the German Army, 1914–1918* (Westport, CT: Praeger, 1989), p. 87.

[19]Gudmundsson (1989), p. 165.

failure set the stage for the general German collapse and defeat that fall. While the storm trooper tactics worked very well on a tactical level the first few days of the campaign, they suffered from a number of weaknesses that were never rectified by the end of the war given the level of technology available to the German army at that time. The storm trooper detachments found themselves quickly outrunning both their fire support and logistics, which could not keep up over shell-scarred terrain with the assault units. Inadequate German rations led to discipline problems as the troops overran relatively well-stocked British supply bases and began looting and foraging for food. Most importantly, there was a serious problem with communications: dependent on messengers or land lines, there was no good way for units that had made tactical breakthroughs to communicate word of their success quickly to higher headquarters, which was in turn unable to reallocate reserves in a timely fashion.[20] Successful flat organization requires, to repeat, a combination of decentralized and centralized decisionmaking. Decentralized, independent action was critical in probing for weak spots in the enemy line and adapting to chaotic battlefield conditions; centralized command authority was necessary for taking full advantage of the local information generated by lower-level units.

Despite the operational failure of the Ludendorff offensive and the strategic failure on the western front, the German General Staff believed that storm trooper tactics had validated themselves during the final year of the war. The principle of independent action by lower-level units remained after 1918 as the kernel of what would over the next two decades mature into the doctrine of *Blitzkrieg*.[21] In experiments painstakingly carried out during the 1920s and early 1930s, Heinz Guderian and his colleagues incorporated two pieces of new technology that finally enabled the principle of rapid, independent action to be realized with devastating effectiveness. The first was, of course, the tank, employed not just in support of infantry but in all-tank units. The second, however, was a piece of information tech-

[20]Van Creveld (1984), p. 181; Addington (1971), pp. 26–27; Gudmundsson (1989), pp. 167–168.

[21]For a general discussion of *Blitzkrieg*, see James S. Corum, *The Roots of Blitzkrieg, Hans Von Seeckt and German Military Reform* (Lawrence, KS: University of Kansas Press, 1992).

nology, the mobile radio. By the mid-1930s, the Germans had designed mobile radio sets that were small and rugged enough to move with armored forces, and they developed a concept whereby the radios would be issued to individual tanks as a means of controlling deep, fluid panzer operations.[22] Only in this way would it be possible for higher headquarters to keep track of rapidly developing penetrations and reallocate resources to exploit successful ones, and for lower-level units to signal higher headquarters. The Germans, in other words, achieved "enhanced situational awareness." Indeed, the Germans caught on quickly that the fast pace of mobile warfare required more direct reporting channels. German front-line panzer units could request air support directly from the *Luftwaffe* without having to go through higher Army echelons. By contrast,

> The Allied command structure was too cumbersome for quick reactions required in mobile warfare. Gort, commanding the BEF [British Expeditionary Force], had nominally to go through two intermediary headquarters, those of Bilotte and Georges . . . before he could reach Gamelin. The latter relied solely on the civilian telephone system to connect him with Georges' headquarters. French teaching between the wars had so emphasized methodical preparation before the battle that few, if any, of the French commanders were capable of thinking in "tank time."[23]

While *Blitzkrieg* depended on these technological systems to be viable, other aspects of flat German military organization that contributed substantially to the *Wehrmacht*'s fighting power were simply matters of management. German staffs were significantly smaller than their U.S. counterparts during the war; a small managerial hierarchy was able to control a vast military machine (numbering over 6.5 million men at its peak) through decentralization of a large number of functions to the unit (generally, regimental) level.[24] The system depended on trust: relatively junior officers were given wide responsibilities for the welfare of the men under their control, with

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[22]Kenneth Macksey, *Guderian: Creator of the Blitzkrieg* (New York: Stein and Day, 1976), pp. 50–51, 66–67.

[23]Charles Messenger, *The Blitzkrieg Story* (New York: Scribners', 1976), p. 131.

[24]Martin Van Creveld, *Fighting Power: German and U.S. Army Performance, 1939–1945* (Westport, CT: Greenwood Press, 1982), p. 62.

low emphasis on rank, status, and the like. To allow such a system to operate, higher headquarters were usually careful not to burden lower echelons with routine reporting requirements. Rather than demanding daily reports on actual strength, casualties, and so forth, reporting was done on a ten-day cycle.[25] In addition, proper training was critical: junior officers and NCOs had to be trained to think for themselves and to make decisions independently.[26]

All armies on both sides of the Great War experimented with independent assault units, but only the Germans persevered in their development. In contrast to the Germans, the French came away from World War I with precisely the opposite conclusions on the question of flat organization. By the end of the war, the French General Staff had replaced its former doctrine of *l'offense à l'outrance* with a much more conservative, defensive-minded one emphasizing massed fires. The French General Staff concluded that the war had been won through the employment of massive artillery fires on wide fronts, coordinated and precisely integrated with infantry advances. French interwar doctrine stressed firepower over movement and, consequently, a high degree of command centralization necessary to coordinate the vast "curtains of fire" needed to carry out this kind of operation.[27] Advances were precisely timed with phase lines and tightly scripted movements; rather than advancing at all costs, frontline units were ordered to wait for the methodical redeployment of supporting artillery. Unlike the Germans, the French did not distribute artillery assets to lower-level units, but kept them under the control of higher headquarters.[28] This kind of doctrine did not, naturally, encourage independent thinking and responsibility on the part of subordinate officers; rather, obedience to the master plan was put at a premium.

It was also more difficult for the French to implement decentralized command and control, even if their doctrine had urged them to do

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[25]Van Creveld (1982), p. 63.

[26]James S. Corum, *The Roots of Blitzkrieg* (Lawrence, KS: University of Kansas Press, 1992), pp. 68–96.

[27]Robert A. Doughty, *The Seeds of Disaster: The Development of French Army Doctrine 1919–1939* (New York: Archon Books, 1985), p. 67.

[28]Doughty (1985), p. 105.

so, because of the different way in which their army was mobilized. Since the time of the Revolution, France had seen its military as the "nation in arms," relying on mass mobilization of short-term conscripts rather than a permanent cadre of professional officers and NCOs. The kind of training they were able to give such a force, and consequently the kinds of responsibilities they could delegate to it, were therefore quite different from the German case. The size of the German army, by contrast, was constrained by the Versailles Treaty, and it necessarily developed as a smaller, more professional corps.

The flat, fluid German doctrine and the centralized, mechanical French one were put to the test in May 1940, with results that are well known. German success in using *Blitzkrieg* tactics in Poland, France, and Russia ensured that they would be carefully studied and copied by virtually all armies over time, including the U.S. Army. Nonetheless, adoption of the principles of flat organization—the related concepts of mission orders, commander's intent, decentralized execution, and rapid, independent maneuver—took a long time to put down roots in American practice. Individual commanders like George S. Patton or "P" Wood, commander of the 4th Armored Division in Patton's Third Army, had somehow come to a deep understanding of the principles of maneuver warfare on their own.[29] But in many respects, the U.S. Army remained much more centralized along French lines in both doctrine and practice. Martin Van Creveld, comparing German and U.S. manuals for land warfare during the war, notes that while the former saw war as something akin to an art form that could not be formalized in rules and regulations, the latter placed a consistent emphasis on "scientific management" à la Frederick Taylor, with the latter's ambitions of precise oversight and control.[30] The U.S. Army's wartime doctrinal manual, FM 100-5, attempted to foresee many more situations than its German counterpart, HDV 300, and provided guidance in much greater detail. At the same time, it failed to stress the importance of independent action, unlike the German manual.[31]

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[29]For an account, see Hanson W. Baldwin, *Tiger Jack* (Fort Collins, CO: Old Army Press, 1979).

[30]Van Creveld (1982), pp. 32–33.

[31]Van Creveld (1982), p. 46.

It should be noted that while flat combat organizations have clearly achieved great successes at a tactical and operational level, their adoption does not guarantee strategic success. Napoleon, Ludendorff, and the *Wehrmacht* in World War II all ultimately went down to crashing defeats. These defeats, of course, could not ultimately be traced to deficiencies in the concept of flat organization. In all cases, strategic defeat was the result of a miscalculating political leadership that set wildly overambitious goals for their armies to achieve, from the invasion of Russia in 1812 to a two-front European war in 1914 to the disastrous invasion of Russia in 1941. It might be argued that this kind of strategic overextension was in part attributable to the very success of flat combat organizations at a tactical level. Victories like Jena-Auerstädt in 1806, or the Battle of France in 1940, may have led to expanded political goals. But miscalculation by political leaders can hardly be laid at the doorstep of military organization; the importance of flat organization to military success is fully validated on the tactical and operational levels.

CURRENT U.S. ARMY DOCTRINE

The U.S. Army has never pursued maneuver warfare and flat military organization as single-mindedly as the German military in this century. As noted above, during World War II the U.S. Army tended to be more firepower-oriented, hierarchical, and centralized than its German counterpart.[32] During the interwar period, doctrine was heavily influenced by the French experience, and maneuver-oriented commanders like Patton were very much the exception. There were efforts to innovate with flat organizations—most notably, with the Pentomic division of the 1950s, which eliminated the battalion echelon and controlled five companies from each brigade headquarters.[33] The Pentomic concept, developed largely as a means of dealing with tactical nuclear weapons in a land war, was scrapped by the end of the 1950s.

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[32]See George A. Higgins, "German and U.S. Operational Art: A Contrast in Maneuver," *Military Review.* Vol. 65, No. 10 (October 1985), pp. 22–29.

[33]On the Pentomic division, see Bacevich (1986) and John J. Midgley, Jr., *Deadly Illusions: Army Policy for the Nuclear Battlefield* (Boulder, CO: Westview Press, 1986).

The power of maneuver warfare concepts was such, however, that they were ultimately absorbed into U.S. Army doctrine. *Auftragstaktik* was translated directly into mission orders and commander's intent, and the principles of decentralized command were written into doctrine manuals. In a certain sense, the land warfare component of the AirLand Battle doctrine developed in the 1980s was an attempt to codify the rules of maneuver warfare under conditions of modern technology.

The performance of the U.S. Army during the Gulf War can be interpreted as reflecting both the maneuver concepts of AirLand Battle and the more methodical, firepower-oriented approach.[34] The operations of Lieutenant General Gary Luck's XVIII Airborne Corps on the far left flank of the coalition's front, and particularly Major General Barry McCaffrey's 24th Mechanized Division, are generally seen as implementing in classic fashion the principles of maneuver warfare, moving rapidly to block the retreat of the Iraqi Republican Guard. On the other hand, Lieutenant General Frederick Franks' VII Corps was heavily criticized both during and after the war for moving too slowly and deliberately once it became clear that the Republican Guard was withdrawing north. It was asserted that Franks excessively emphasized synchronization and centralized control driven by phase lines and timetables.[35] Many of Franks' defenders have argued that his deliberateness was fully justified by the situation, given his desire not to incur friendly-fire casualties through night operations; in any case, his corps achieved a striking victory over the Iraqi forces they engaged.[36] It is not our purpose to adjudicate this particular historical dispute, except to note that the issue of how maneuver doctrine ought to be applied in practice, and the appropriate degree of command centralization, continues to be a live issue within the Army.

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[34]Robert H. Scales, Jr., *Certain Victory: The U.S. Army in the Gulf War* (Washington, D.C.: Brassey's, 1994).

[35]These criticisms were made, in the first instance, by Norman Schwarzkopf himself. See Michael Gordon and Bernard Trainor, *The Generals' War: The Inside Story of the Conflict in the Gulf* (Boston: Little, Brown, 1994), pp. 303–304. For a rather immoderate critique, see James G. Burton, "Pushing Them Out the Back Door," *U.S. Naval Institute Proceedings* (June 1993), pp. 37–42.

[36]Steve E. Dietrich, "From Valhalla with Pride," *U.S. Naval Institute Proceedings* (August 1993), pp. 59–65.

If one looks at U.S. Army doctrine as it developed by the mid-1980s, it is clear that it contained all of the essential principles of both maneuver warfare, decentralized command and control, and flat military organization. Consider, for example, the following passages from the 1986 version of FM 100-5:

> In the chaos of battle, it is essential to decentralize decision authority to the lowest practical level because overcentralization slows action and leads to inertia. At the same time, decentralization risks some loss of precision in execution. The commander must constantly balance these competing risks, recognizing that loss of precision is usually preferable to inaction.[37]

A variety of other documents have made similar points. For example, the TRADOC pamphlet on battalion and company operations asserts:

> Battalion commanders must believe that they have the trust and confidence of the brigade and division commanders. They cannot waste time second-guessing their decisions and worrying about whether they are meeting their commander's intent. There has to be an open line of communication, up and down, at all levels of command. Commanders must have the ability to listen as well as the ability to dictate because subordinates have things to say which are pertinent. This openness creates a climate of trust, both from the commander to his subordinate, and from the subordinate to his commander.[38]

Or, to quote from an analysis of Operations Just Cause and Desert Storm,

> We lived off of crosstalk. At division level, many of the tough problems were solved by brigade commander crosstalk. We'd grab the

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[37]FM 100-5 (1986), p. 15. It goes on to state that subordinates

> must thoroughly understand the commander's intent and the situational assumptions on which it was based. In turn, the force commander must encourage subordinates to focus their operations on the overall mission, and give them the freedom and responsibility to develop opportunities which the force as a whole can exploit to accomplish the mission more effectively.

[38]*Leadership and Command on the Battlefield: Battalion and Company* (TRADOC Pamphlet 525-100-2), p. xi.

> issue before it had gotten up to division, and either make a decision on what to do and execute with the commander monitoring, or paint a picture of the alternative so the commander or ADC(M) could make a decision.[39]

The latter quote suggests that the division was not a critical command echelon, and that many decisions were made based on lateral communications between brigade commanders. The Army appears to have backed away from its doctrine on decentralized authority in the 1993 version of FM 100-5. It is not clear to what extent these changes in doctrine have influenced the actual training and behavior of officers in the field. Since it is critical to the issue of flat military organization, however, we thought it important to provide a detailed comparison of the 1986 and 1993 versions.

COMPARISON OF THE 1986 AND 1993 VERSIONS OF FM 100-5

Since the two versions differ from each other in terms of their overall structure, it is hard to make exact comparisons between them with respect to command-and-control issues. Nevertheless, it appears that the 1993 version places somewhat less emphasis on the delegation of authority to subordinate leaders and their freedom to operate; the differences, however, tend to be ones of degree rather than kind.

The section on "Command and Control" in the 1986 version (pp. 21–22) is replaced by a subsection entitled "Battle Command" (one of seven "combat functions") in the 1993 version (pp. 2-14 to 2-15). The section in the earlier version focuses on the question of how to promote flexibility and freedom to operate for subordinate leaders. Some of the main themes are

- The initial plan "will establish commander's intent and concept of operations and the responsibilities of subordinate units. It will, however, leave the greatest possible operational and tactical freedom to subordinate leaders."

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[39] *Leadership and Command on the Battlefield: Operations Just Cause and Desert Storm* (TRADOC Pamphlet 525-100-1), p. 30.

- "Mission orders that specify *what* must be done without prescribing *how* it must be done should be used in most cases."
- "Control measures should secure cooperation between forces without imposing unnecessary restrictions on the freedom of junior leaders."
- Such a system needs
  - — "routine use of warning orders . . ."
  - — "standardized training in operations and staff practices to assure mutual understanding . . . throughout the Army and its sister services . . ."
  - — "war gaming, rehearsals, and realistic training [to] promote initiative and flexibility by preparing . . . for cooperation . . . without time-consuming coordination."

By contrast, the 1993 version places more emphasis on commander's role: "To command is to direct. Command at all levels is the art of motivating and directing soldiers and their leaders into action to accomplish missions."

The 1993 version does, however, contain a major statement concerning the importance of flexibility for subordinate leaders, as follows:

> The need for flexibility in command is greatest for the committed maneuver unit commander. He can neither cope with constant direction from above nor can he constantly provide detailed direction to his staff and subordinate commanders. He and his organization must know the intent of the commander two levels above, understand the concept of operation and intent of the immediate commander, and know the responsibilities of flanking and supporting units. Then, the unit commander can fight his unit confidently. He can anticipate events and act freely and boldly to accomplish his mission with minimal guidance, *particularly when he cannot communicate with his commander.* (Emphasis added.)

It is of interest that the phrase "particularly when he cannot communicate with his commander" is absent from 1986 version; the 1986 version, therefore, tends to be somewhat more forceful in presenting this flexibility as a virtue in itself.

Another interesting difference between the two versions is in the illustrative historical example contained in each. The 1986 version describes the seizure of the Rhine bridge at Remagen in the following terms: "An infantry platoon leader who understood the goal of his division commander acted promptly and without orders to secure an advantage that altered the course of the Army's whole campaign."

The 1993 version, by contrast, discusses Joshua Chamberlain's defense of Little Round Top at the Battle of Gettysburg. While Chamberlain's tactics were daring and unusual, his action did not illustrate the same type of initiative as shown by the platoon leader at Remagen, since he (Chamberlain) was acting within his orders in defending a fixed position, rather than going beyond them in exploiting an unforeseen opportunity.

The discussions of *initiative* and *synchronization* as tenets of AirLand Battle doctrine (in the 1986 version) or Army Operations (1993 version) also show some changes. The 1986 version's discussion of *initiative* (pp. 15–16) contains the passage quoted above emphasizing the need for decentralized command authority. The 1993 discussion (pp. 2-6 to 2-7) is shorter and less detailed:

> In battle, initiative requires the decentralization of decision authority to the lowest practical level. At the same time, decentralization risks some loss of synchronization. Commanders constantly balance these competing risks, recognizing that loss of immediate control is preferable to inaction. Decentralization demands well-trained subordinates and superiors who are willing to take risks.

It drops several important points: that the subordinates have to understand the commander's intent and the situational assumptions on which it is based, and that the subordinates must be willing to take risks and their superiors must be willing to nurture such risk taking.

The discussion of *synchronization* in the two versions is of interest because this requirement often seems to pose a serious challenge to decentralization and flexibility. According to the 1986 version (p. 17),

> synchronization may and usually will require explicit coordination among the various units and activities participating in any operation... Synchronization need not depend on explicit coordi-

> nation if all forces involved fully understand the intent of the commander, and if they have developed and rehearsed well-conceived standard responses to anticipated contingencies. In the chaos of battle, when communications fail and face-to-face coordination is impossible, implicit coordination may make the difference between victory and defeat... The less that synchronization depends on active communication, the less vulnerable it will be [to enemy disruption].

The 1993 version (p. 2-8) merely implies that implicit coordination may be possible: "Synchronization *usually* requires explicit coordination among the various units and activities participating in any operation" (emphasis added). However, it omits the earlier version's discussion of the ways or situations in which explicit coordination may not be necessary or possible.

FACTORS THAT ENCOURAGE THE CENTRALIZATION OF AUTHORITY

Despite the watering down of the sections on decentralized command and control, current U.S. Army doctrine adequately reflects the principles of flat military organization, decentralized battlefield authority, and bottom-up initiative. Nonetheless, the Army remains in many respects highly centralized, hierarchical, and to many observers, excessively rigid and bureaucratic. Why is it, then, that despite the doctrinal emphasis on flatness, the Army at times appears to be a steep pyramid?

Part of the answer, in our view, is that hierarchy is a matter of necessity: there are certain functions an army has to carry out that require centralized authority, and certain contemporary trends that push the U.S. Army to an even higher degree of centralization than previously. On the other hand, *a substantial degree of hierarchy and centralized control is the result of culture:* many officers interviewed in the course of this project felt that the Army, despite its doctrine, does not adequately train officers in the principles of decentralized command, or else does not adequately reward them later in their careers for engaging in independence of action at lower command levels. As noted in Chapter One above, a modern flat commercial organization has elements of both decentralized and centralized authority; both are necessary to make the organization function

properly. The secret to proper organizational structure is to understand which roles or functions need to be decentralized and which ones are better left to centralized authority. We need, therefore, to begin to sort these issues out.

The following six factors are broad, generic functions that an army must perform that tend to produce centralization:

- Strategic planning
- Fire support
- Logistics
- Medevac
- Intelligence
- Political factors.

In some cases (e.g., strategic planning and logistics), there is an inherent logic behind centralization; in others (e.g., intelligence), the degree of centralization implied in the function depends on how it is carried out. We will discuss each one in turn.

Strategic Planning

Highly decentralized organizations cannot move rapidly, decisively, stealthily, as a whole; if an action requires the rapid or covert mobilization of most or all of their resources, they are likely to be at a loss. Network organizations like the Internet or Visa, while very good at adaptation, are never called upon to act as an entire organization. While certain types of coordination can and should be performed through lateral communications between peers within a network—e.g., maintaining boundaries between units along a front—many forms of strategy, operations, and in many cases tactics require centralized control. Napoleon's campaigns, and the campaigns of Guderian and his later followers in Western armies, were all centrally planned and directed; the maneuver warfare doctrine developed in this tradition mandates decentralized execution, not decentralized planning.

Fire Support

Again, fire support has been one of the traditional sources of organizational centralization in modern militaries. The contrast between the French and German lessons learned from World War I were echoed in the rivalry between maneuver and firepower camps in other armies.

The nature of fire support is changing very rapidly today as a consequence of the "revolution in military affairs" (RMA), which joins information technology to munitions and has produced the possibility of highly precise fires coming from a wide variety of platforms. Many theorists of the RMA have envisioned a future battlefield in which a deep, wide, and tall battlespace will be rendered largely transparent, and in which fires could be directed from as near as a direct-fire weapon and as far away as another continent. In our view, there is a real possibility that the RMA will produce pressures for increased command-and-control centralization (discussed at greater length below).

Logistics

The long and heavy logistics tail—growing longer and heavier with each generation of main battle tank—has long been one important reason why the rapid, deep penetrations envisioned in maneuver warfare doctrine have been difficult to realize in practice. While Army doctrine speaks of a future "nonlinear" battlefield, there is no clear concept of how such a nonlinear army would be kept supplied.

In the commercial world, logistics—whether on the part of companies like Brown and Root whose primary business is logistics, or companies like Wal-Mart which have to provide logistics services as part of their internal operations—has seen tremendous IT-based technological innovation and consequent gains in productivity. It is only natural that military logistics should move in the same direction. Logistics is an area that benefits from economies of scale. As indicated in the discussion of flat organizations in Chapter One, a company like Wal-Mart has achieved efficiencies in its retail distribution system by devolving certain management responsibilities but

also by centralizing others, particularly by centralizing the IT systems used to keep track of inventory. Federal Express is another example of a company that has used a centralized IT architecture to manage a complex logistics system. Plans now under way at the Combined Aims Support Command (CASCOM) envision achieving similar scale economies through the centralization of logistics management and intensive use of IT.[40] In essence, instead of distributing logistics to units at a low level, whether they were needed or not, the new system uses IT to identify logistics requirements in real time and moves supplies to exactly the points where they are needed. Logistics is also ideally suited for skip-echelonning and other forms of flattening, since many command levels in the Army do nothing more than process and pass on logistics information. This Wal-Mart type of distribution system could never be made as lean as it is for a commercial retailer, but the Army could nonetheless realize substantial efficiencies.

Medevac

Like logistics, medevac is another factor that could tie units to their support areas and prevent the development of deep, fluid battles; however, this may be overcome by the widespread availability and use of helicopters for this purpose.

Intelligence

Historically, the unification of the intelligence community under the Director of Central Intelligence after the National Security Act of 1947 has meant that intelligence was administered in a centralized manner within the U.S. national security community. Unlike logistics, it is not clear that intelligence benefits from scale economies or necessarily becomes better with more centralization. Naturally, certain large national systems have to be operated by the intelligence community in a fairly centralized manner, but often it is the timely delivery of information that is critical. In this respect, intelligence architectures themselves could benefit from organizational flatten-

[40]U.S. Army Combined Arms Support Command, *Vision of Combined Arms Support* (30 October 1992).

ing. Every hierarchical layer that intelligence information has to pass through, whether on the way up from the sensor to the interpreter/analyst or down to the final consumer, means the possibility of delay and distortion. Whether or not intelligence will act as a centralizing factor, however, depends on the type of intelligence architecture adopted. Future architectures may use wide-bandwidth communications to broadcast data to all subscribers simultaneously; each echelon would then be able to select the information relevant to its responsibilities. By providing a suitably tailored display based on a common data base to all echelons, intelligence may facilitate the flattening of command structures. In other words, commanders at each level will be able to take more initiative because they will have confidence that they have the data necessary to understand the overall situation.

Political Factors

By political factors, we mean primarily the so-called CNN effect, that is, the tendency for military operations to be put under a media microscope and ruthlessly analyzed, with significant political consequences. The CNN effect is a very significant deterrent to organizational flattening in virtually all U.S. public-sector organizations, not just the military. The reason is that flat organizations necessarily devolve power and authority, and thereby increase the short-run chances of failures, mistakes, incompetence, and outright corruption. A commercial organization can usually accept a higher level of risk because the corresponding benefits in terms of innovation or efficiency are much greater. A public-sector organization faces different incentives because the benefits of flattening tend to be hard to measure, while the short-term risks can become glaringly obvious. The way that the American political system has developed over the past couple of generations has increased the degree of scrutiny and criticism for virtually all public-sector organizations, and this has led to a kind of "zero-defects" mentality on the part of Congress, the press, and the public at large with regard to public administration. That is, an official who tries a new, experimental approach and fails is put in the same category as an official who is simply incompetent or, worse yet, corrupt.

The Gulf War provides a good example of how the CNN effect makes flat military organization difficult to implement. During that conflict, target selection for the air campaign was centralized under the Joint Forces Air Component Commander (JFACC), Air Force General Buster Glosson.[41] The Bush administration at the beginning of the war was determined to devolve responsibility for the actual conduct of the war to the military. The White House was particularly concerned not to repeat what it regarded as the Johnson administration's mistake of micromanaging military operations during the Vietnam War, as when President Johnson selected individual bombing targets. The JFACC indeed ran the air campaign with a minimum of political interference, up until the bombing of the al-Firdos bunker on the night of February 13, 1993. On that occasion, American F-117s dropped bombs on what the JFACC believed to be an Iraqi command-and-control bunker, which was in fact being used to shelter the families of senior Iraqi officials. A large number of civilians were killed during the raid, the results of which were displayed on CNN the following day. The political controversy engendered by the raid then led the Bush administration to intervene in the target-selection process, taking Baghdad off the target list for much of the remainder of the war and requiring Glosson to clear further politically sensitive targets with the Chairman of the Joint Chiefs, Colin Powell.[42]

The al-Firdos bunker incident shows that it is in fact possible to flatten military organizations for a certain period. Over time, however, the likelihood increases that some mistake, misjudgment, or accident will occur. It is impossible to routinize error-free flat organization; when errors occur in a politically sensitive environment, there is a tendency to recentralize authority.

The zero-fault-tolerant character of the political process explains the inefficiency of many American public agencies. Government procurement, including military procurement, suffers from precisely

[41]On command arrangements during the Gulf War, see James A. Winnefeld, Preston Niblack, and Dana J. Johnson, *A League of Airmen: U.S. Air Power in the Gulf War* (Santa Monica, CA: RAND, 1994), pp. 96ff.

[42]Gordon and Trainor (1994), p. 326.

this problem.[43] In a commercial organization, a procurement officer can often be given considerable freedom to use his or her judgment in buying from suppliers known for their reliability or quality. Efficiencies show up on the bottom line relatively quickly, and there are quick sanctions for incompetence or fraud. Public-sector procurement could conceivably be run in a similar manner, with public agencies accepting occasional instances of fraud or waste as a cost of doing business. Because of the politicized nature of procurement, however, and because it is too tempting for Congress or the media to publicize any given instance of mistaken judgment, past cases of abuse have created numerous layers of auditing controls designed to reduce the procurement officer's freedom of judgment. It has been understood for many years now that these auditing layers drive up the cost and stretch out the length of government procurement projects, but administrations and Congresses have been unwilling to accept the political consequences of a flatter form of procurement.

Will the RMA Tend to Centralize Authority?

As noted above, the need to synchronize and coordinate fire support has often encouraged greater centralization. In this context, the so-called revolution in military affairs (discussed above) may prove to be a potent force for centralization.

According to a TRADOC publication,

> The domination of extended battlespace will require agile and robust deep and simultaneous attack capabilities . . . advances in this dynamic may drive a reassessment of the traditional relationship between fire and maneuver.
>
> . . . twenty-first century commanders will have the capability to see the entire battlefield in depth, identify key targets—particularly moving and short-dwell targets—and attack with a wide choice of

[43]For an overview of the military procurement problem, see *Integrating Commercial and Military Technologies for National Strength: An Agenda for Change* (Washington, D.C.: Center for Strategic and International Studies, 1991) and Jacques Gansler, *Affording Defense* (Cambridge: MIT Press, 1991), pp. 141–214.

> joint, as well as Army systems, whenever and wherever the commander desires.[44]

If this vision comes to fruition, there may be strong pressures to centralize control of all the diverse fires in a single command in order to deconflict the various systems and ensure that they are used in the most efficient manner possible. The decentralization inherent in maneuver warfare doctrine is geographically based; that is, each subordinate unit is able to take the initiative with respect to its immediate geographic area and the enemy forces that directly confront it. While lateral communication with adjacent friendly forces is important to protect one's flanks and prevent the enemy from breaking through in the gaps between units, a unit can, for tactical purposes, be unconcerned with what is going on at the other end of the battlefield.

In the RMA vision, on the other hand, geography matters much less; a unit can attack enemy forces far away from it, and can be threatened by distant forces as well. Since fires will be longer range and more agile, i.e., able to target distant parts of the battlefield very rapidly, there will be a major loss of efficiency if they are made organic to one subordinate unit. The requirements for deconflicting fires and avoiding fratricide will also be more complex. Thus, there may be a tendency to centralize control of them with higher-level commanders. Indeed, the excerpt cited above seems to assume that the fires from these agile and diverse sources of fire support will have to be responsive to a single commander.

Besides deconfliction, resource scarcity may encourage centralization of command-and-control systems as the RMA develops. Many of the concepts for localized control of fires tacitly assume unlimited and cost-free resources, whereas the reality is that many modern weapons are both scarce and expensive. As in any economic system, scarce resources can be allocated either through markets, by which suppliers and consumers bid against each other, or through an administrative hierarchy that determines priorities. There is at present no alternative to allocation through a hierarchy for high-value fires in modern military organizations, and until a market-like allocation

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[44] *Force XXI Operations,* TRADOC Pamphlet 525-5 (1 August 1994), paragraph 3-2c.

system is devised, the cost and scarcity of RMA-type resources will simply reinforce the need for hierarchical, authoritative allocation.

This is not to say that centralization is the inevitable result of the types of developments foreseen in the RMA; it may prove to be possible to develop new forms of control that allow subordinate commanders to exercise extensive initiative. However, these forms would probably have to be quite different from what is familiar from the past; for example, there could be a kind of "bidding" or "point" system by means of which requests for long-range fire support were fed into a centralized data base and filled or denied semiautomatically (that is, according to a computerized algorithm which could be overridden by a higher-level commander). Under ordinary circumstances, such a system could provide rapid and generally predictable responses to the requests of lower-level commanders, thus enabling them to take local initiative; when required, however, higher-level commanders could make strategic-level decisions concerning concentration of effort, main axes of attack, etc.

A system of this type would be difficult to devise and would probably require a great deal of experimentation and testing before anyone would be willing to use it in combat. That one can envisage such a system shows that the RMA need not lead to increased centralization; its strangeness, however, suggests that centralization of command authority might be the RMA's natural tendency.

Chapter Three

IMPLICATIONS FOR THE ARMY

According to a World War II story, a regimental sergeant-major in the British Army was becoming increasingly irritated by draftees who, in their eagerness to get on with the fighting, were impatient with the rituals of military life. "I'll be happy when this war is over," he is supposed to have said, "and we can get back to real soldiering." The differences between an army in combat and one in peacetime garrison have always been great and, in many respects, reflect the issues we have been discussing. In combat, armies tend to become "flatter" (not with respect to their organization charts, of course, but in their manner of operation) as a matter of necessity if not doctrine. Thus, one would expect that the corporate reorganization literature would suggest larger changes in the peacetime army than in the army as it engages in combat.

Because the issues involved tend to differ greatly, we discuss the two cases separately. We will discuss them under the headings of the "TO&E (Table of Organization and Equipment) Army," which refers to the Army's combat elements, and the "TDA (Table of Distribution and Allocation) Army," which includes everything else (Army staff, organizations dealing with research and development, procurement, personnel, etc.). However, it should be noted that this distinction, while useful because it corresponds to a major distinction between Army components, is not precisely the same as that between peacetime and wartime: for most of the time, the TO&E Army is operating in a peacetime mode and subject to many of the same pressures as the TDA Army.

TO&E ARMY

The corporate analogy would suggest that the main task with respect to the TO&E Army is, by facilitating and speeding up information flows, to shorten the cycle time for decisions and to improve their quality. This section will discuss two major approaches for accomplishing this: the exploitation of information technology (IT), and the possible elimination of command echelons.

"Informating"

Information technology (IT), the combination of telecommunications and computers, has great potential for speeding up the flow of information and ensuring that it gets to the right place at the right time in the right format. At the same time, the introduction of new means of communication can be counterproductive if it leads to information "overload," the swamping of communications circuits with routine reporting that interferes with the transmission and reception of critical information. In addition, the additional reporting burden on subordinate units can interfere with their ability to fulfill more crucial tasks.

One solution to this difficulty goes by the name of "informating," which is the application of automation to information processes in order to minimize the reporting burden, avoid "information overload," and gain the greatest possible value from the available data.[1] The key is to automate the required information processes and then tailor the display of the data to the particular needs of the various consumers at different echelons and with different responsibilities. Automation can be applied to data collection, transmission, aggregation, processing, and presentation.

In such a system, information is collected automatically or as a by-product of other operations. As already discussed, one of the best-

[1]The term "informate" was coined by Shoshana Zuboff to describe the process by which information is automatically generated about the "underlying productive and administrative processes through which an organization accomplishes its work," thereby providing "a deeper level of transparency to activities that had been either partially or completely opaque." *In The Age of the Smart Machine: The Future of Work and Power* (New York: Basic Books, 1988), pp. 9–10.

known examples of this is the Wal-Mart system, in which the information that a particular product has been sold, which is obtained at the counter when the barcode is scanned, is not only used to calculate how much the customer owes, but is also transmitted to a companywide data base. Thus, without increasing the workload of the checkout clerk, and without placing any burden on other company employees, timely and detailed sales information is collected for processing and use.

The information is then processed to make it useful to various consumers. At one level, it may be aggregated to supply top management with a sense of the immediate trends in the overall business of the company. The same information can also be used in more detailed and targeted fashion to facilitate, for example, ordering more of a given product that is selling rapidly; in some cases, the suppliers are directly tied into the Wal-Mart data system and receive orders automatically. With less urgency, historical sales data can be analyzed to spot longer-term patterns in consumer preference.

In some cases, the processing is done automatically according to predetermined algorithms, delivering a predetermined product to designated consumers. In addition, the processing algorithm can recognize certain situations as requiring the intervention of management (e.g., sales figures that change rapidly in a short period of time, wide discrepancies between stores with similar customer bases, etc.) and "alert" the appropriate official. Finally, the data base can be interrogated by managers who wish to know more about how a specific product is selling, how one region differs from another, what the seasonal trends are, etc. The manager of a store can compare his own sales figures to those of neighboring stores or of stores situated in neighborhoods that are similar in socioeconomic terms to determine how well he is doing, and in which areas he might be able to improve.

Thus, the data are made available to a wide variety of consumers within the organization in formats specifically tailored to their needs. This avoids the problem of "information overload." In addition, this is accomplished without burdening a large number of employees with transmitting, aggregating, and processing the data, tasks that can absorb a great deal of time and energy in traditional hierarchies.

A military analog to such a system would be one in which transmitters on one's own vehicles automatically report their position (as determined by a GPS receiver), either to a central data base or on a net. This information would then be processed in order to display the position of a defined set of vehicles when required by a commander. (Similar systems are used in the commercial world to enable trucking companies to track the locations of the vehicles in their fleets.) Similarly, POL (petroleum, oil, and lubricants) and ammunition usage and status could be determined by sensors and transmitted; the same might be possible for data on the operability of vehicles.

With appropriate processing, this information could be made available to a variety of consumers in formats tailored to their requirements. For example, higher-level commanders could review the information in a more aggregated form, while those at lower levels might want to see it on a battalion-by-battalion, or company-by-company, basis. At the same time, the same information could be aggregated into a form useful for logistics planning; with appropriate security precautions, data that are classified when they deal with specific identified units could be made available, once aggregated and otherwise sanitized, on an unclassified basis.

In designing such a system, a key point to be kept in mind is that, because a vast amount of very specific and "low-level" data is reported from each unit (e.g., the POL level for each and every tank), the resulting data base contains much more information than any one consumer could possibly make use of. Thus, the danger of "information overload" is a real one; if any consumer were to receive all, or even a significant fraction, of the total amount of data contained in the system, he would be hopelessly swamped. Thus, the systems for aggregating and processing the data are as crucial as those for collecting them in the first place. If the latter outrun the former, the result is likely to be a system that is less usable than the less-sophisticated one it replaces.

Informating can support a doctrine of decentralized execution, since it makes it easier to provide more detailed and timely information to lower-level commanders, thereby enabling them to act more rapidly and flexibly. A battalion commander can be more informed about

the status of neighboring battalions and better able to judge the consequences for the entire position of his taking a specific initiative.

In this sense, informating can be seen as a decentralizing influence, since it enables information to move more flexibly throughout the organization, not just in vertical reporting channels. At the same time, however, it is important to note that it depends on the existence of universally valid standards. Each part of the system (sensor, communications device, information processor, output device) must be compatible with the other parts in terms of data formats, etc. While the various subsystems can be developed independently, they must adhere rigorously to the standards and protocols that will enable them to interact.

For this reason, the adoption of such a system cannot be seen as a merely technical issue; rather, it inevitably acquires a "political" dimension since it requires different parts of the organization to reach some type of agreement. While this might be accomplished on the basis of consensus among the various parts, it is more likely to require forceful intervention by the leadership.

There are various reasons why this type of "top-down" control may be necessary. Aside from considerations of ego, different parts of the organization may have existing "legacy" systems that they do not wish to replace; however, interconnectivity may require at least some of them to be scrapped. In addition, there may be conflicts of interest; what works best for one part of the organization may not be optimal for some other part.

An additional source of resistance may arise from the desire of each component of the organization to control the flow of information, either to preserve its power to influence key decisions or to prevent embarrassment (when the data would show that that component's performance had been lacking). For example, the more detailed information available about a given unit's operation, the more others will feel able to offer advice, challenge decisions, or otherwise intervene; similarly, mistakes will be more obvious to outsiders. Thus, while the component may pose all sorts of technical objections to the informating scheme, its real concern may be that it will lose control of information about its own operations.

In sum, given the importance of the information system, decisions about its structure may actually be decisions about the way in which the entire organization will function; thus, the active involvement of top management may be indispensable.[2]

Of course, informating doesn't solve all the possible problems that improved communications can create: for example, the availability of more detailed and current information may tempt superior echelons to "micromanage" decisions that should be left to their subordinates. Commanders must be aware of this temptation and be trained to resist it.

Shorter Data Paths

Informating effectively shortens data paths by obviating the need for intermediate levels of the command hierarchy to process and retransmit (or "massage") the data as it is passed up or down the chain. Instead, for example, data reported by the lowest level can be rapidly available throughout the entire chain of command, suitably aggregated at each stage.

Informating, however, can be applied only with respect to information that can be represented in a quantified and formatted form. In other cases, involving more qualitative information, this type of procedure may not be possible. Nevertheless, the same shortening of data paths may be achieved in the absence of informating by authorizing the skipping of echelons for certain types of communications. The familiar device of the "directed telescope," whereby a higher-level commander empowers an agent to gather information directly from a unit several layers below him in the hierarchy, is such a method for speeding up communications with a subordinate who is involved in a particularly critical operation. Similarly, if the high-

[2]"I think that CEOs increasingly recognize the impact that [information] technology decisions have on their business and their corporate culture. As a result, they are becoming less comfortable delegating technology decisions to others." Bob L. Martin, president and CEO of Wal-Mart Stores' International Division. His is one of six essays by experts on corporate information systems, published in "The End of Delegation? Information Technology and the CEO," *Harvard Business Review*, Vol. 73, No. 5 (September–October 1995), pp. 161–172. (Passage quoted appears on p. 162.)

level commander visits a front-line unit personally, he has effectively shortened the data paths by skipping the intermediate echelons.

As these examples indicate, such shortening of the data paths is often an ad hoc affair, undertaken on the battlefield as necessity demands. Such improvisation is often necessary, although it does run the risk of creating confusion if the bypassed intermediate levels are not informed of what is going on.

A more extreme version of this phenomenon may occur during operations other than war (OOTW), in which individual actions can take on political significance. For example, in operation Restore Democracy in Haiti, the actions of a single squad in Port-au-Prince could have had significant repercussions, especially if they had been captured on tape by CNN and broadcast to the world. As a result, White House officials may wish to be in direct communication with units on the ground, both to receive reports directly (otherwise, they could find themselves in the uncomfortable position of receiving press inquiries about events of which they hadn't been yet informed) and to direct actions on the ground (in order to avoid unwanted incidents).

Although this type of political "micromanagement" is typically unwelcome, it is probably inevitable given the politically sensitive nature of many OOTWs. As in the previous case, probably the best that can be done to avoid any resulting confusion is to ensure that intermediate commanders are kept informed of what is being communicated directly between higher and lower levels.

As opposed to this type of ad hoc echelon-skipping, where the challenge is to balance the advantages of flexibility against the confusion that can be created when intermediate echelons are left in the dark on matters that both their superiors and subordinates are aware of, one could envisage a policy decision to mandate direct communication between nonadjacent echelons with respect to a given function. For example, it might be possible to mandate that a company or battalion report certain types of logistics information directly to a theater-level support agency, bypassing the intervening echelons.

In general, one could imagine that a thorough study of future Army command and control could involve a review of all the functions performed by the command hierarchy to see which levels were crucial for each, and which merely transmitted, aggregated, and/or pro-

cessed data on its way from one echelon to another. New IT, including informating techniques, would enable one to design shorter, more direct communication paths which, with respect to a given function, bypassed the echelons that didn't have a substantial role to play.

In this manner, one obtains some of the benefits of flattening without *actually changing the organizational structure.* In other words, the process has been changed (i.e., shorter data paths) in a way similar to what would occur if the organizational structure had in fact been flattened. While this report has, in general, focused on issues of organizational structure, some of the lessons, as in this case, are applicable even independently of changes in organizational structure.

Flattening

Ultimately, there is the possibility that IT, by facilitating communications and the processing of data, will permit an extension of the span of control and hence a reduction in the number of echelons. In the late 1950s, the idea that increased flexibility of command would be required to operate in a tactical nuclear environment led to the Pentomic Army concept, in which the battalion echelon was abolished.[3] To compensate, the span of control at the division and battalion level was increased to five battalions and five companies, respectively. Although the concept was soon abandoned as mistaken, it may be that, from an organizational point of view, it was premature rather than simply wrong.

While the corporate literature suggests that such flattening could be a useful step, it must be kept in mind that it is not a goal in itself, only a possible means toward the ultimate goal of creating a force that can react more quickly to events, especially unforeseen ones. The litera-

[3]See A. J. Bacevich, *The Pentomic Era: The U.S. Army Between Korea and Vietnam* (Washington, D.C.: National Defense University Press, 1986), chapter 5, for a discussion of this reorganization. The driving force behind the Pentomic Army concept was the need to prepare to fight on a battlefield on which both sides were prepared to use tactical nuclear weapons. Many of its features are related to the issue of tactical nuclear weapons and are not of interest here. What is of interest is the attempt to "flatten" the Army by eliminating an echelon below the corps level.

ture should, however, serve as a reminder that, in thinking about future Army organization, one ought not to take the current echelon structure for granted.

As we have discussed in Chapter One, the primary advantage of flattening an organization is to improve the flow of information from those who have it to those who are in a position to act on it. In general, reducing the number of management layers can not only speed the flow of information from initial acquirer to ultimate consumer (since it has fewer stops to make along the way), but can also increase its accuracy (since there are fewer opportunities for it to be distorted, either inadvertently or deliberately).

It should be noted, however, that this argument focuses on a single, if very important, function of middle management: the aggregation, filtering, and transmission of information. It is of course precisely with respect to this function that the advances in IT suggest that flattening is desirable, since IT facilitates the automation of much of this work. On the other hand, middle management serves other functions as well: it provides leadership to subordinates, performs various specialized functions, and serves as a training group for future leaders (see Figure 10). In considering whether a flatter structure is appropriate, the Army must look carefully at these functions as well.

Of these, the leadership function is the hardest to analyze. Organizational literature addresses this issue by means of the notion of the "span of control," i.e., the number of subordinates who report to a given superior. As noted in Chapter One, corporate reorganizations that follow the recent trends in organization theory have resulted in spans of "control" that run from 20–30 to hundreds of subordinates. Obviously, this is only possible because, in these cases, the superiors do not have to "control" their subordinates in any "hands-on" manner; for the same reason, superiors cannot be expected to be responsible for teaching their subordinates necessary skills or nurturing their growth as potential future supervisors or executives.

In cases such as these, lower-level subordinates are regarded as capable of performing their (limited) functions autonomously, while subordinates who are professionals in terms of their training and responsibilities are seen as capable of guiding their own work. In the

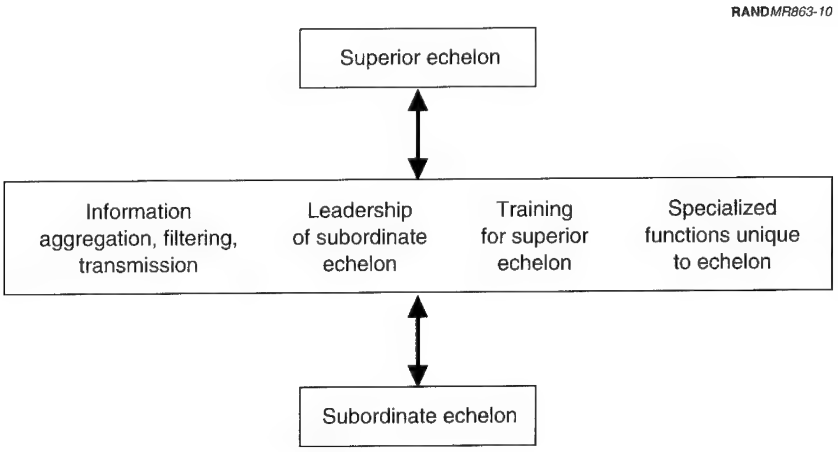

Figure 10—Middle Management Functions

latter case, "control" comes from the subordinate's sense of the standards of one's profession (e.g., a doctor in a hospital, who takes his bearings from the standards of the medical profession and resists allowing the hospital administrator to tell him which course of treatment to follow).

For the Army, the leadership function is much more complicated. In combat, the span of control is important because a superior commander must provide direction to his subordinates. No matter how much initiative the latter are permitted or encouraged to take, and no matter how good the information flow to them, the need for concerted, decisive action will require that, on some occasions at least, superiors actually direct the actions of their subordinates. This places some limits on the feasible span of control, although only experimentation in realistic exercises will provide insight into the question of how large that span of control can be (see Figure 11).

In addition, the peacetime Army poses unique leadership challenges. To a greater extent than in the corporate world, commanders of combat units are expected to provide professional and personal

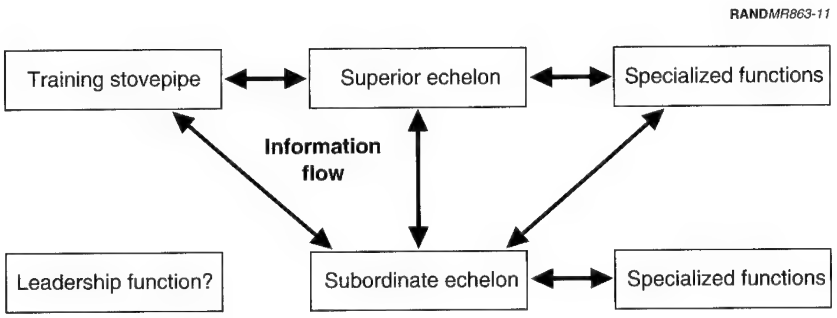

Figure 11—Middle Management Functions Can Be Eliminated or Distributed

leadership to their subordinates.[4] This also implies a limit on the span of control. Thus, with respect to the leadership function, the corporate experience may not be very revealing.

The various specialized functions performed by a command echelon (whether combat functions, such as artillery support, or combat services support functions) could be reallocated to accommodate a flatter organizational structure. In fact, even with the current number of echelons, some functions are being concentrated at higher levels. For example, the proposed centralization of logistics discussed in Chapter Two relies on IT to achieve efficiencies.

It is with respect to the training function that we may see some of the most difficult dilemmas regarding flattening. In the corporate world, it has been noted that the elimination of middle management layers may mean that newly promoted executives are not as well prepared for their new responsibilities as previously; for example, in the Wal-Mart case, the elimination of local warehouses and subregional centers means that an up-and-coming junior executive goes directly from the position of store manager to being responsible for an entire region.

[4]Although the recent prevalence of discussions on the importance of "mentoring" is an example of how the corporate world has adopted certain ideas from the military.

This problem may be even more severe for the Army, since the gradual progression through the ranks is its most important mechanism for training its top leadership. If an echelon is removed, then some way will have to be found to compensate for the experience that officers would have gained by commanding at that echelon. Indeed, the problem is much more important for the Army than for a corporation, since the latter can recruit outsiders into top leadership positions, whereas the Army "grows" its own leaders.

In the corporate world, lateral transfers (as a way of broadening an executive's experience) and formal education have been used to deal with this problem.[5] The Army already uses these training mechanisms. An additional possibility, also used in business training programs, would be games and simulations; as IT makes it possible to have more and more realistic simulations (especially of command functions), this may be an important way of compensating for any decrease in "hands-on" experience.

TDA ARMY

Over the next decades, the Army faces a period of major uncertainties; indeed, the current situation seems to be characterized by greater unpredictability than has been the case for some time. Changes in the international environment make it very unclear what tasks the Army will be called upon to perform; in particular, it cannot know whether it will have to fight a large-scale land war against an adversary with access to significant resources and advanced technology. While it seems evident that the Army will be involved in OOTWs during the coming years, they come in a bewildering variety of forms.

Perhaps even more important are the uncertainties inherent in the effects of technological advances on the future of land war. For example, will the tank's dominance of the battlefield continue, or will advances in other areas—sensors, precision guidance of munitions, long-range strike systems, robotics—make it too vulnerable to survive against a technologically advanced adversary? The answer to

[5]For a discussion of this issue, see Joseph Weber et al., "Farewell, Fast Track: Promotions and Raises Are Scarcer—So What Will Energize Managers?" *Business Week*, December 10, 1990, pp. 192–200.

this question depends of course in large part on the technology available. However, even an accurate grasp of a technology does not guarantee that one can correctly assess its impact on combat; for that, one needs an understanding of how different systems can interact on the battlefield.

Dealing with these uncertainties and taking decisions in the face of them—regarding research and development, procurement, training and doctrine, organization—is the task of the TDA Army. Given the difficulty of making predictions, the current situation would seem to place a premium on being able to adapt quickly to changes in the political and technological environment. In this regard, the Army's challenge is similar to that facing many corporations, especially those involved in rapidly advancing high-technology areas. Such companies cannot make plans that look out over a decade except in the most general terms.

Such a company may decide to invest in R&D in an apparently promising technology area, but won't have a very clear idea of the precise products that will incorporate it. The history of successful companies contains many cases in which important products were launched seemingly by accident, although the ground had been prepared by the cultivation of technological expertise and a willingness to innovate "on the fly":

> In examining the history of the visionary companies, we were struck by how often they made some of their best moves not by detailed strategic planning, but rather by experimentation, trial and error, opportunism, and—quite literally—accident. What looks in hindsight like a brilliant strategy was often the residual result of opportunistic experimentation and "purposeful accidents."[6]

One area of promising future research concerns the development of nonhierarchical means for controlling fires in a future RMA environment. As noted in Chapter Two, RMA technologies are likely to lead to command-and-control centralization due to the scarce-resource problem. That is, while it is desirable to be able to distribute the control of new, precise fires down to the lowest possible

[6]James C. Collins and Jerry I. Porras, *Built to Last: Successful Habits of Visionary Companies* (New York: HarperBusiness, 1994), p. 141.

command echelon, those fires will remain scarce resources that can be easily wasted. Local commanders do not operate under budget constraints, nor is there the equivalent of shadow pricing for fires on particular targets. Scarce resources can be allocated in one of two ways, through a hierarchy or through a market; traditionally, military organizations have chosen hierarchies because no market-like mechanisms have been created to allocate fires within a theater.

Recently, work has been done at the Xerox Palo Alto Research Center to create a computerized double-blind auction for the allocation of thermal resources within a building. Using this program, individual rooms within the building in effect "bid" on heating or air conditioning resources, which are then optimally allocated without the benefit of a centralized hierarchical allocator. While this program applies to the allocation of thermal resources, it is generalizable to the allocation of any type of scarce resource within a single organization. An important line of future research would be to see whether such a program could be applied to the allocation of fires within a theater.[7]

Procurement

The problem of dealing with uncertainty about the future shows up most dramatically in the area of procurement. Especially when dealing with major weapons systems, such as a new tank, the lead time between starting the R&D process and fielding the new system in large numbers is measured in years, if not decades. In an era of rapid technological advance, such lead times can seriously hinder the Army's ability to field the most effective weapon systems possible.

While some of this lead time is inevitable, given the complexity of the systems involved, the problem is exacerbated by the regulatory environment in which the procurement takes place. The delays and inefficiencies of the defense procurement system have been investigated in detail many times, and this study has not sought to dig once

[7]Bernardo Huberman and Scott H. Clearwater, "A Multi-Agent System for Controlling Building Environments," Proceedings of the First International Conference on Multi-Agent Systems, Menlo Park/Cambridge/London: AAAI Press/MIT Press, 1995. Bernardo Huberman and Tad Hogg, "Distributed Computation as an Economic System," *Journal of Economic Perspectives,* Vol. 9, No. 1 (Winter 1995), pp. 141–152.

again in that well-plowed ground. For our purposes, it is sufficient to note that many of the problems associated with the system have long been known, yet very little progress seems to have been made in resolving them.

The difficulties involved in procuring IT have been especially great. This is not surprising, given that technological progress in this area has been particularly rapid; a cumbersome procurement process guarantees that it will be impossible to acquire state-of-the-art equipment. Within the U.S. government, this problem is not unique to the Department of Defense. Other agencies have had similar problems procuring up-to-date IT and related equipment; for example, the inability of the Federal Aviation Administration (FAA) to modernize the air traffic control system has led the administration to propose that a *government-owned corporation*, which could ignore *federal procurement regulations*, be created to handle this function.[8]

Designing a full-scale reform of the government procurement process is far beyond the scope of this study. More importantly, given the amount of energy that has been devoted to this task, one is forced to conclude that the prospects for a thoroughgoing reform are not particularly good. On the other hand, it might be possible to devise some ways around the procurement system. The purpose of these expedients would be twofold: First, they could facilitate the timely acquisition and utilization of equipment that might not otherwise be available. Second, by showing what is in fact possible, they might serve to change the political climate in ways that would ultimately make a full-scale reform more feasible. In short, instead of attempting a head-on attack against a strongly fortified and heavily defended position, one should seek to infiltrate, undermine, and eventually subvert it.

[8]Vice President Al Gore has proposed the creation of a "businesslike government-owned corporation, funded by user fees and working outside of traditional governmental constraints." Of course, it is an open question whether, as a practical political matter, such a corporation could avoid the detailed regulations with which, for example, privately owned defense contractors are burdened. In particular, it is not clear whether the corporation's favored treatment would survive the first scandal that could in any way be traced to its freedom from "traditional governmental constraints." Al Gore, *Common Sense Government: Works Better and Costs Less* (New York: Random House, 1995), pp. 30–31, 123.

One possibility would be to make greater use of "skunk works," i.e., "umbrella" contracts with a given company, which allow for rapid amendment and modifications that can be negotiated on a "sole source" basis. In effect, this short-circuits the government's procurement regulations and makes use of private industry's ability to operate quickly and flexibly. It would also foster a close relationship between the program office and the contractor, which could familiarize the officers and civilian government officials in the program office with commercial practices. This could tend to increase pressures to reform the standard procurement system.[9]

Typically, skunk works have been used primarily for secret ("black") programs; the secrecy shrouding these projects, imposed because of the sensitivity of the technology involved, had the additional effect of helping them avoid the usual types of controls associated with the defense procurement regime. However, the skunk works format also makes sense for projects that are not particularly sensitive and that, like many IT initiatives, make use of commercially available technology.

Another possibility would be to use "wartime" procurement procedures during military operations other than war (MOOTW). As is well known, a new hard-target penetration bomb, the GBU-28, was developed during the Gulf War in a six-week period and was used just before the cease-fire to destroy a leadership C^3 bunker.[10] One could search for (or create) other opportunities in which to do the same thing. Thus, the political saliency of Operation Joint Endeavor in Bosnia is sufficiently high that it might be possible to procure systems to support it under a "wartime" exception to the rules.

For example, one could argue that air-implanted sensors for surveillance of base perimeters, for convoy security against ambushes, etc., would be sufficiently useful that suspension of the procurement

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[9]Commercial firms themselves use "skunk works," and for much the same reason: to provide a venue for technological experimentation and progress unconstrained by the company's own bureaucratic procedures. The dissemination of skunk works' experiences to the rest of the corporation cannot be taken for granted: in some cases, such as Xerox's Palo Alto Research Center, the parent company did not absorb advances made by the skunk works.

[10]Department of Defense, *Conduct of the Persian Gulf War,* Report to Congress, April 1992, p. 148.

regulations should be authorized in order to procure them rapidly: since such devices have been used in the past, no technological advances would be required to develop and procure a useful system. Given the danger to the success of the Bosnian mission posed by widespread minefields, development of new mine-clearing techniques and equipment on an emergency basis could be justified. Similarly, one could search for opportunities to telescope the development process by the deployment of systems that are not yet in the operational inventory, such as JSTARS in Desert Storm and in Joint Endeavor and Predator in Deliberate Force.

In general, opportunities of this type should be sought out, both to exercise the system so that it will be better able to operate rapidly in case of war, and to highlight the cost of the current regulatory regime. One might attempt to institute a system whereby, in the case of any ongoing operation, some amount of money would be made available for the development and procurement of equipment under "wartime" rules. A similar procedure might even be adopted for selected major exercises; for example, some funds could be made available early in the planning process for the development and procurement of equipment considered particularly relevant to the exercise.

In general, corporate experience is unlikely to be very relevant with respect to procurement, since the main difficulties are unique to the government. However, many corporations have faced the issue of making their procurement operations more efficient. Unfortunately, many of the techniques they have used may be impossible for a government agency to implement.

For example, the American automobile industry, generally following the Japanese model, has tended to forge closer and more long-term relationships with its suppliers, moving away from the notion that every contract should be broadly competed on the basis of price. The underlying view is that a long-term relationship, on the basis of which it is possible to share information and expertise, will produce a better quality/price mix in the long run than will an "arm's-length" approach that constantly forces suppliers to compete with each other. While the automobile company may not, due to diminished competition, get the best price on every contract, the argument runs,

its steady suppliers will, for various reasons,[11] gradually improve in efficiency and hence offer lower prices in the long run.

In isolated instances (generally with regard to "black" programs), government agencies are able to adopt similar practices; however, the main thrust of government procurement regulations goes in the opposite direction: against "single source" procurement and in favor of competing each contract.

Experimentation

The rapid pace of change creates uncertainties not only with respect to procurement but in other areas as well. Doctrinal questions relating to tactics and organization will also be subject to frequent change. Since IT is evolving particularly rapidly, to the extent that the state of the art with respect to it affects these issues, one must expect higher than usual degrees of turbulence. As corporations have discovered, major changes in information systems have wide-ranging effects throughout the organization, many of which come as surprises as the members of the organization learn how to use the new system and exploit more and more of its potential.[12]

Although the implementation of a new information system often requires a high degree of centralized control (for example, a large amount of "clout" may be required to ensure that the different parts of the organization adopt compatible IT equipment and systems), the process of refining it and learning how to make optimal use of it requires a great deal of experimentation. While "digitization of the battlefield" may well lead to major changes in the Army's organization, there is probably no way to design an optimal structure now. The information systems that current and evolving IT will make feasible will have unpredictable effects on how war is fought.

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[11]The supplier will be able to plan his production better, since he will have a better sense of precisely what parts will be needed, when, and in what quantities. By tapping into the automobile company's expertise, he will be able to improve his production processes; working closely with the assembly plant, he will get quicker feedback about the quality of his product and can fix defects sooner. See James P. Womack, Daniel T. Jones, and Daniel Roos, *The Machine That Changed the World* (New York: Harper Perennial, 1991), pp. 146ff.

[12]This point is the central thesis of Shoshana Zuboff, *In the Age of the Smart Machine.*

This suggests that the major goal must be to make the Army a more adaptive organization, especially for the period of this major transformation. There will have to be a great deal of experimentation to discover the best use of the new information systems and to refine them to exploit their full potential. Part of this experimentation will have to involve new organizational forms as well; for example, a major issue would be whether, given the new information systems, it makes sense to institute a greater span of control and hence a flatter organizational structure with fewer echelons.

This suggests a major change in the way the Army prepares for the future. In principle, its behavior in this regard should be characterized by

- Constant experimentation with new ideas and methods as the new information systems are absorbed.
- Pursuit of multiple alternative solutions.
- Careful analysis of actual operations in order to extract the maximum amount of information from real-world experience.
- Willingness to make frequent, small changes in methods and structure as new lessons are learned.

This type of experimentation should go on in multiple locations within the Army, including specially designated experimental forces or "testbeds," such as EXFOR or the 9th Infantry Division of the early 1980s. In addition, units with specialized capabilities, such as the 82nd Airborne Division and the 101st Air Assault Division, should experiment with respect to issues specifically related to them.

Fostering this type of experimentation imposes a number of requirements. First is the issue of financial resources. Ideally, an experimental unit ought to have some funds available to procure items on a trial basis without having to go through normal procedures. This would be especially true of IT equipment, which evolves very rapidly and is available "off the shelf" in great variety and sophistication. Expertise should be available at the unit level to help in this

regard; for example, the XVIII Airborne Corps's "science advisor" provides the components of that unit with information on potentially relevant current technological developments. A network of such science advisors could assist units in this regard and serve as a mechanism for disseminating positive experiences from one unit to the rest of the Army.

Money is not, however, the only resource that would be necessary; the units must have the time to engage in this type of work. The currently high operational tempo of the Army, due to its involvement in various MOOTWs, poses one obstacle in this regard. Beyond that is the issue of readiness levels; to the extent that a unit must maintain a high readiness level, its ability to devote time and effort to experimentation will be limited. It is thus an important question whether a designated experimental unit, such as EXFOR, should be required to maintain high readiness as well.

Obviously, this poses much larger resource questions for the Army. If testbed units were to be protected from MOOTW deployments and their readiness requirements were to be relaxed, then other parts of the Army would have to take up the slack. Under current conditions, this may not be feasible.

When corporations experiment, they may be able to tell right away whether an idea is a good one or not, since they are involved in their business on a day-to-day basis. For the Army, of course, the real test of a new tactic or organizational structure doesn't come until it is tried in actual combat. Thus, a great deal of effort must be put into developing methods for trying things out in a test environment as close to the real thing—combat—as possible. Resources such as the National Training Center (NTC) are vital for this effort.

Thus, the third key resource, in addition to money and time, is access to facilities like the NTC. At present, units are rotated through the NTC for training and evaluation. The goal is to ensure that they are qualified according to current doctrine and to evaluate their capabilities. Increasing the adaptiveness of the Army will require such facilities to also be made available for experimentation. However, this goal is not compatible with the training and evaluation goals; the new methods being tested may not require the same skills as those for which the unit is to be qualified, and it would be unfair to evalu-

ate unit or commander competence on the basis of actions taken as experiments, some of which should be expected to fail. Thus, time on current facilities will have to be reallocated, or new facilities created.

As noted, it is inherently easier for corporations to experiment than for the Army, since, in many cases, they can do so under "real-world" conditions in which success or failure becomes readily apparent. Nevertheless, other facets of the issue may be similar. For example, both corporations and the Army face the problems of disseminating information and ideas from an experimental unit to the rest of the organization; ensuring that service in the experimental unit is attractive to high-quality personnel and rewarding good performance in the unit; and protecting the experimental unit against political pressures emanating from the rest of the organization.

Disseminating information and ideas often turns out to be harder than it might seem. For example, Xerox, in its Palo Alto Research Center (PARC) "skunk works," developed many of the concepts that are basic to personal computer operating systems today. Nevertheless, these ideas were never effectively communicated to the rest of the corporation, with the result that Xerox lost out on a potentially lucrative market.

An experimental unit's potential can be limited if the organization's personnel do not see service in it as an attractive career option. This type of problem requires high-level attention to make sure that the organization's promotion system does not favor those who have risen via the traditional stepping stones over those who have served in experimental units.[13]

There may be a tension between these two needs: to disseminate information from an experimental or innovative unit, and to protect the career prospects of those who serve in it. The reason is that interchange of personnel between experimental and conventional

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[13]In this regard, it is worth noting that the current Chairman of the Joint Chiefs of Staff, General John M. Shalikashvili, served as commander of the 9th Infantry Division, the Army's "high-technology test bed" intended to develop a new type of light division, from June 1987 to August 1989. His tenure, however, marked the end of the division's life as an experimental unit. Michael J. Mazarr, *Light Forces and the Future of U.S. Military Strategy* (Washington, D.C.: Brassey's (U.S.), 1990), p. 25.

units is an effective way of disseminating new information and ideas, while one way of achieving the latter goal is to create a separate career track for these personnel, in order to make sure that their career opportunities are not slighted by members of the larger organization. This, however, may tend to isolate them in certain positions, thereby reducing the flow of information. In the Army, for example, the creation of a separate branch for the Special Forces may have ensured that those officers were treated more fairly with respect to promotions, but at the cost of limiting their presence in infantry units, thereby hindering the flow of information and ideas.[14]

Finally, the experimental unit must be protected from any political pressures that might emanate from the rest of the organization, either because of competition for resources, because it seems to threaten other parts of the organization, or because of jealousy or some other discontent. Essentially, this is a job for the top management, since the experimental unit will not be likely to have its own resources with which to fight. (In the case of the Army, it may be that there is congressional interest in the experiment, which could be an important source of support.)

In general, this will mean that the head of the organization must take an interest in the effort. In this regard, the Chief of Staff of the Army suffers a major disadvantage as compared to a corporate CEO. A CEO is likely to be in his position for ten years or more, while the Chief's tenure is, as a practical matter, limited to four years. It is possible to outwait a Chief of Staff of the Army, but not the average CEO.

TRAINING AND PERSONNEL

"Freedom to Fail"

The types of changes discussed above will require adjustments in the personnel system to accommodate them. There appear to be two major issues: encouraging risk taking and improving training and competence at the lower levels of the organization.

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[14]This thought was expressed to the authors by some infantry officers in the XVIII Airborne Corps.

Many voices in the Army have spoken out against the "zero defects" mentality and in favor of instituting a "freedom to fail."[15] This is particularly important if one wishes to foster an adaptive and innovative culture, in which individuals are to be encouraged to try new methods and to attempt unorthodox approaches. Obviously, some of these attempts will fail, and if the system is not able to distinguish between failures that are inevitable in the course of reasonable experimentation and failures that result from plain incompetence, then innovative behavior will be seen as too risky. For example, the Israeli army has the reputation for overlooking serious failures when they are seen as resulting from the taking of reasonable risks, and when the individual's positive characteristics are considerable. Thus, Ariel Sharon's unauthorized move into the Mitla Pass in the 1956 Sinai Campaign, which resulted in large casualties, did not derail his military career.

Institutionalizing "freedom to fail" is probably particularly difficult to accomplish in an era of downsizing, when there is extra pressure to separate, or not to promote, individuals who would otherwise be considered as meeting the standards of the organization. In such an atmosphere, those charged with these difficult decisions are likely to seize on an obvious mistake as an easily defensible justification for a negative evaluation. Unless counteracted, this is likely to induce too much caution into the organization, as everyone comes to fear that a single mistake could be his or her last.

Concomitant with providing "freedom to fail," the system must be able to adequately reward successful innovation; in particular, in order not to discourage experimentation, the reward for extraordinary success resulting from "out of the box" thinking must be sufficient to overcome the penalties for failure. Otherwise, trying something new, that may or may not work out, will appear to be a losing proposition in terms of one's own career.

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[15]"[W]e must display positive, creative leadership, *stamp out this zero defects mentality* and create an environment where all soldiers can reach their full potential." General Dennis J. Reimer, "Leadership for the 21st Century: Empowerment, Environment and the Golden Rule," *Military Review,* Vol. 76, No. 1 (January–February 1996), p. 6 (emphasis added). General Reimer emphasizes throughout the article that the "zero defects mentality" puts tremendous pressure on commanders not to report candidly about problems in their units.

Emphasizing exceptional success, as opposed to the absence of obvious failures, makes the selection process more subjective; there are bound to be greater differences of opinion as to what constitutes a significant achievement denoting exceptional competence than as to what is a blunder. This implies the risk that "politics" (in the pejorative sense of clientism, the favoring of those in one's own "clique") may play a greater role in the selection process. It also means that it will be harder to operate an Armywide selection process, since a greater familiarity with specific actions will be required in order to make judgments. Unless OERs can be made more informative, it may be harder for promotion board members who do not know the individuals being considered to make decisions about them.

More generally, promotion paths within the organization must make it possible for those who are involved in experimental efforts to have a fair chance of rising to the top. If, for example, experimental units are created, then service in them must be considered as prestigious as service in standard combat units.

In this regard, the Army's branch structure may pose some problems. Service in an experimental unit may involve responsibilities that cut across the traditional branch boundaries. In any case, an experimental unit has to be free to examine concepts that go against the traditions of a branch and might even threaten its interests. Thus, it may be necessary to create a special "track" for officers who serve in these units to make sure that their promotion opportunities are not restricted as a result.

Distribution of Skills in the Organization

If organizations are to be flatter and more adaptive, they will require a greater distribution of skills throughout their various levels. Those at the lower echelons will be called on to act more independently than before; many parts of the organization will be expected to engage in some experimentation, and innovation will not be the preserve of a few specialists. This implies not only the need for more training, a trend already in evidence in the Army, but also a recognition that those at lower levels in the hierarchy can play an important role in achieving overall success and can make an important contribution by improving their skills at their present levels. In other

words, promotion need not be regarded as synonymous with career development and "success."

In corporations, for example, specialists may not be "promoted" if that means that they would have to give up exercising their special talent and become managers; an excellent computer programmer may in fact make an indifferent manager. Instead, the company can reward the specialists by increasing their salaries, giving them more challenging projects to work on, and assigning them "mentoring" responsibilities by which they impart their knowledge and experience to younger specialists.

Many of these techniques may not be feasible in the Army; salary, for example, is set by law and is associated with rank. (Similarly, among civilian government employees, grade and hence salary level is heavily determined by the number of employees one supervises.) The critical issue, however, is the "up or out" personnel system, which implies that an excellent company commander must either be promoted to a higher level of responsibility or separated from the service. This contradicts the notion of the "flat" organization, in which the retention of skills at the bottom of the hierarchy is crucial.

CONCLUSION: THE IMPORTANCE OF NETWORKS AND CULTURE

We noted earlier that networks can be understood as informal communities sharing certain norms or values, and that such trust networks are often overlaid on formal organizations where they serve to facilitate the movement of information. We noted that while the existence of such trust networks is critical to the proper functioning of an organization, they can themselves serve as obstacles to the free flow of information by creating network outsiders who are excluded from information sharing.

From what we have observed of the U.S. Army, it is our view that it is permeated with informal trust networks of all sorts. Through its officer training and doctrine, it seeks to inculcate a broad "corporate culture." Beyond that, however, there are numerous subnetworks and subcultures: each of the branches generates its own trust network; West Point graduates as a whole and each individual class at West Point constitute networks of varying importance; officers who

have served in the same unit, particularly under stressful or demanding conditions, later constitute a network when they have dispersed to new assignments. The existence of these networks is critical to the smooth functioning of the Army, even if they are never explicitly recognized, since they are important routes for the horizontal transmission of information.

It is our observation, however, that the structure of informal networks within the Army can also be dysfunctional and serve as an impediment to the diffusion of innovations through the service. We noted earlier that Silicon Valley firms were not only characterized by corporate cultures overlaying each individual organization; they were also linked horizontally by networks that transcended firm boundaries. Within the Army, there are clearly informal trust networks based on large formal organizational units like the branch, corps, and so on. Loyalty to such networks, however, often impedes the lateral flow of information. A good case in point (noted earlier) was the Special Operations Forces, which used to enjoy a healthy collaboration with the XVIII Airborne Corps in terms of technologies and ideas. This fruitful interchange tended to dry up as the Army special forces became a separate branch, and "ownership" of them (along with the special forces of the other services) was shifted to the new joint Special Operations Command (SOCOM). Many ideas tended to live and die within a single corps, or within even smaller units, because of the absence of networks spanning unit boundaries.

It should be clear that an informal trust network overlaid on top of a formal hierarchy can do a great deal to counteract the barriers to information flow created by the hierarchy itself. Indeed, it may be much more important for organizations to map their informal networks and internal cultures than to rearrange their formal lines of authority. The German army in 1940 had exactly the same number of echelons as the French army; it functioned as an effectively flatter organization, however, because it was pervaded by a much less hierarchical culture.

This suggests that the Army, in seeking an effectively flatter organization, should pay attention not simply to the question of how many echelons it should maintain in its formal structure, but also to the informal status barriers that block innovation and information flow. One observer notes that an important advantage of Silicon Valley

firms over a Route 128 company like Digital Equipment (DEC) was the relative informality of social relations in California as compared with the Boston area.[16] Both Intel and DEC are hierarchical firms in terms of formal organization, but Intel managers were much more casual in their relations with subordinates and did not stand on formal rank nearly as much as their DEC counterparts. In this regard, we should note that, in the view of many observers, Army culture resembles the hierarchical DEC much more than the egalitarian Intel, as manifested *inter alia* in the willingness of officers to brook contradiction by subordinates two or three echelons down. It may be that some degree of hierarchical culture is necessary to maintain discipline within the formal organization; on the other hand, there is evidence that other effective armies (such as those of Israel and, at times, Germany) have been less rank- and status-conscious in the internal cultures of their officer corps. On the other hand, the U.S. Army is noteworthy for the uncommonly large amount of authority and responsibility it delegates to its noncommissioned officer corps.

Organizational models developed in the civilian economy obviously cannot be slavishly followed by military organizations. But there is enough similarity between the tasks of commercial firms seeking to adjust to a rapidly changing business and technological environment, and the peacetime U.S. Army seeking to adapt to changes in its external environment, that some degree of convergence is inevitable. As noted earlier, changes do not go in a single direction: many of the innovations in corporate management like teams and broad spans of control have been pioneered by military organizations. The U.S. Army, for its part, needs to recognize that the benefits of changes in technology cannot be fully realized until they are incorporated into new organizational forms, and that organizational innovation is as important as innovation in weapon systems.

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[16]Saxenian (1991), Chapter 3.